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ABSTRACT

In 1995 the Virginia Board of Education adopted new Standards of Learning in four core subject areas: mathematics, science, English, and history and social science. The new standards set targets and expectations for what teachers need to teach and students need to learn. The requirement is designed to provide greater accountability on the part of public schools and give local school boards the autonomy and flexibility to offer programs that best meet the educational needs of students. This document contains the new standards, which are the result of collaboration among teachers, parents, principals, school board members, community leaders, and national experts. Standards are described in detail for mathematics, science, English, history, and the social sciences at each grade level from kindergarten through grade 12. (LMI)

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STANDARDS OF LEARNING

for Virginia Public Schools

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Board of Education
Commonwealth of Virginia

June 1995

EA 027 623

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STANDARDS OF LEARNING

for Virginia Public Schools

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A Special Message

The Board of Education has taken an important step to raise the expectations for all students in Virginia's public schools by adopting new Standards of Learning in four core subject areas: mathematics, science, English, and history and social science.

The new Standards of Learning are important because they set reasonable targets and expectations for what teachers need to teach and students need to learn. Clear, concise academic standards will let parents and teachers know what is expected of students, and each student's performance and achievement can be measured against the standards. This requirement provides greater accountability on the part of the public schools and gives the local school boards the autonomy and flexibility they need to offer programs that best meet the educational needs of students.

The standards contained in this publication are the result of an unprecedented partnership of educators and citizens. Under the leadership of four school divisions beginning in April 1994, thousands of Virginia's parents, teachers, principals, school board members, and community leaders contributed many hours of time to help review and revise drafts of proposals for the new standards. National experts were consulted. Public meetings were held across the state to hear from citizens. Thousands attended, and hundreds more wrote letters to share their suggestions. All of the comments and ideas were reviewed by the Board of Education as the standards were developed.

One of the most important things that schools and communities can do together is to set clear, rigorous, and measurable academic expectations for young people. The new academic standards adopted by the Board of Education are part of Virginia's efforts to provide challenging educational programs in our public schools.

James P. Jones
President, Board of Education

William C. Bosher, Jr.
Superintendent of Public Instruction

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Mathematics Standards of Learning

for Virginia Public Schools

Mathematics Standards of Learning

The Standards of Learning for Mathematics identify academic content for essential components of the mathematics curriculum at different grade levels for Virginia's public schools. Standards are identified for kindergarten through grade eight and for a core set of high school courses. Throughout a student's mathematics schooling from kindergarten through grade eight, specific content strands or topics are included. These content strands are Number and Number Sense; Computation and Estimation; Measurement; Geometry; Probability and Statistics; and Patterns, Functions, and Algebra. The Standards of Learning for each strand progress in complexity at each grade level and throughout the high school courses.

The Standards of Learning are not intended to encompass the entire curriculum for a given grade level or course or to prescribe how the content should be taught. Teachers are encouraged to go beyond the standards and to select instructional strategies and assessment methods appropriate for their students.

Goals

Students today require stronger mathematical knowledge and skills to pursue higher education, to compete in a technologically oriented workforce, and to be informed citizens. Students must gain an understanding of fundamental ideas in arithmetic, measurement, geometry, probability, data analysis and statistics, and algebra and functions, and develop proficiency in mathematical skills. In addition, students must learn to use a variety of methods and tools to compute, including paper and pencil, mental arithmetic, estimation, and calculators. Graphing utilities, spreadsheets, calculators, computers, and other forms of electronic information technology are now standard tools for mathematical problem solving in science, engineering, business and industry, government, and practical affairs. Hence, the use of technology must be an integral part of teaching and learning. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Please note the computer/technology standards following the grade five and grade eight standards, respectively. The teaching of these skills should be the shared responsibility of teachers of all disciplines.

The content of the mathematics standards is intended to support the following four goals for students: becoming mathematical problem solvers, communicating mathematically, reasoning mathematically, and making mathematical connections.

Problem Solving

Students will apply mathematical concepts and skills and the relationships among them to solve problem situations of varying complexities. Students also will recognize and create problems from real-life data and situations within and outside mathematics and then apply appropriate strategies to find an acceptable solution. To accomplish this goal, students will need to develop a repertoire of skills and strategies for solving a variety of problem types. A major goal of the mathematics program is to help students become competent mathematical problem solvers.

Mathematical Communication

Students will use the language of mathematics, including specialized vocabulary and symbols, to represent and describe mathematical ideas, generalizations, and relationships. Representing, discussing, reading, writing, and listening to mathematics will help students to clarify their thinking and deepen their understanding of the mathematics being studied.

Mathematical Reasoning

Students will learn and apply inductive and deductive reasoning skills to make, test, and evaluate mathematical statements and to justify steps in mathematical procedures. Students will use logical reasoning to analyze an argument and to determine whether conclusions are valid. In addition, students will learn to apply proportional and spatial reasoning and to reason from graphs.

Mathematical Connections

Students will relate concepts and procedures from different topics in mathematics to one another, using a variety of representations—graphical, numerical, algebraic, verbal, and physical. Through the application of content, students will make connections between different areas of mathematics and between mathematics and other disciplines, especially science. Science and mathematics teachers and curriculum writers are encouraged to develop mathematics and science curricula that reinforce each other.

Kindergarten

The kindergarten standards place emphasis on counting; combining, sorting, and comparing sets of objects; recognizing and describing simple patterns; and recognizing shapes and sizes of figures and objects. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

K.1 The student, given two sets containing 10 or fewer concrete items, will identify and describe one set as having more, fewer, or the same number of members as the other set, using the concept of 1 to 1 correspondence.

K.2 The student, given a set containing nine or fewer concrete items, will

- tell how many are in the set by counting the number of items orally;
- select the corresponding numeral from a given set; and
- trace over the numeral using tactile materials (e.g., sand, sandpaper, carpeting, or finger paint).

K.3 The student, given an ordered set of three objects and/or pictures, will indicate the ordered position of each item, from left-to-right, right-to-left, top-to-bottom, and/or bottom-to-top.

K.4 The student will investigate and recognize patterns from counting by fives and tens, using concrete objects and a calculator.

K.5 The student will count forward to 20 and backward from 10.

K.6 The student will determine the value of a collection of pennies, using pennies or models.

Computation and Estimation

K.7 The student will add and subtract whole numbers using up to 10 concrete items.

K.8 The student, given a familiar problem situation involving magnitude, will

- select a reasonable magnitude from three given quantities: a one-digit numeral, a two-digit numeral, and a three-digit numeral (e.g., 5, 50, and 500); and
- explain the reasonableness of his/her choice.

Measurement

K.9 The student will recognize a penny, nickel, dime, and quarter.

K.10 The student will identify the instruments used to measure length (ruler), weight (scale), time (clock: digital and analog; calendar: day, month, and season), and temperature (thermometer).

K.11 The student will tell time to the hour using an analog or digital clock.

K.12 The student will compare two objects or events, using direct comparisons or nonstandard units of measure, according to one or more of the following attributes: length (shorter, longer), height (taller, shorter), weight

(heavier, lighter), temperature (hotter, colder). Examples of nonstandard units include foot length, hand span, new pencil, paper clip, block, etc.

Geometry

K.13 The student will identify, describe, and make plane geometric figures (circle, triangle, square, and rectangle).

K.14 The student will identify representations of plane geometric figures (circle, triangle, square, and rectangle), regardless of their position and orientation in space.

K.15 The student will compare the size (larger/smaller) and shape of plane geometric figures (circle, triangle, square, and rectangle).

Probability and Statistics

K.16 The student will gather data relating to familiar experiences by counting and tallying.

K.17 The student will display objects and information, using object and pictorial graphs and tables.

K.18 The student will investigate and describe the results of dropping a two-colored counter or using a multicolored spinner.

Patterns, Functions, and Algebra

K.19 The student will sort and classify objects according to similar attributes (size, shape, and color).

K.20 The student will identify, describe, and extend a repeating relationship (pattern) found in common objects, sounds, and movements.

Grade One

The first-grade standards introduce the idea of fractions and continue the development of sorting and patterning skills. In first grade, students will learn the basic addition facts through the fives table and the corresponding subtraction facts. Students also will draw and describe certain two-dimensional figures and use nonstandard units to measure length and weight. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

1.1 The student will count objects in a given set containing between 10 and 100 objects and write the corresponding numeral.

1.2 The student will group concrete objects by ones and tens to develop an understanding of place value.

1.3 The student will count by twos, fives, and tens to 100.

1.4 The student will recognize and write numerals 0 through 100.

1.5 The student will identify the ordinal positions first through tenth, using an ordered set of objects.

1.6 The student will identify and represent the concepts of one-half and one-fourth, using appropriate materials or a drawing.

1.7 The student will count a collection of pennies, a collection of nickels, and a collection of dimes whose total value is 100 cents or less.

Computation and Estimation

1.8 The student will recall basic addition facts, sums to 10 or less, and the corresponding subtraction facts.

1.9 The student will solve story and picture problems involving one-step solutions, using basic addition and subtraction facts.

Measurement

1.10 The student will identify the number of pennies equivalent to a nickel, a dime, and a quarter.

1.11 The student will tell time to the half-hour, using an analog or digital clock.

1.12 The student will use nonstandard units to measure length and weight.

1.13 The student will compare the volumes of two given containers by using concrete materials (e.g., jelly beans, sand, water, and rice).

1.14 The student will compare the weight of two objects using a balance scale.

Geometry

1.15 The student will describe the proximity of objects in space (near, far, close by, below, up, down, beside, and next to).

1.16 The student will draw and describe triangles, squares, rectangles, and circles according to number of sides, corners, and square corners.

1.17 The student will identify and describe objects in his/her environment that depict geometric figures: triangle, rectangle, square, and circle.

Probability and Statistics

1.18 The student will investigate, identify, and describe various forms of data collection in his/her world (e.g., recording daily temperature, lunch count, attendance, and favorite ice cream).

1.19 The student will interpret information displayed in a picture or object graph using the vocabulary: more, less, fewer, greater than, and less than.

Patterns, Functions, and Algebra

1.20 The student will sort and classify concrete objects according to one or more attributes, including color, size, shape, and thickness.

1.21 The student will recognize, describe, extend, and create a wide variety of patterns, including rhythmic, color, shape, and numeric. Patterns will include both growing and repeating patterns. Concrete materials and calculators will be used by students.

Grade Two

The second-grade standards extend the study of number and spatial sense to include three-digit numbers and three-dimensional figures. Students will continue to learn and use the basic addition facts through the nines table and the corresponding subtraction facts. Students will also begin to estimate and make measurements. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

2.1 The student will identify the place value of each digit in a three-digit numeral, using numeration models.

2.2 The student will compare two whole numbers between 0 and 999, using symbols (>, <, or =) and words ("greater than," "less than," or "equal to").

2.3 The student will identify the positions first through twentieth, using an ordered set of objects.

2.4 The student will identify the part of a set and/or region that represents one-half, one-third, one-fourth, one-eighth, and one-tenth and write the corresponding fraction.

2.5 The student will count by twos and fives to 100 and by threes and fours to 96, using mental mathematics, paper and pencil, hundred chart, calculators, and/or concrete objects.

Computation and Estimation

2.6 The student will recall basic addition facts, sums to 18 or less, and the corresponding subtraction facts.

2.7 The student, given two whole numbers whose sum is 99 or less, will

- estimate the sum; and
- find the sum using various methods of calculation (mental computation, concrete materials, and paper and pencil).

2.8 The student, given two whole numbers each 99 or less, will

- estimate the difference; and
- find the difference using various methods of calculation (mental computation, concrete materials, and paper and pencil).

2.9 The student will solve addition and subtraction problems using data from simple charts and picture graphs. Problems will require a one-step solution.

2.10 The student, given a simple addition or subtraction fact, will recognize and describe the related facts which represent and describe the inverse relationship between addition and subtraction (e.g., 3 + __ = 7, ___ + 3 = 7, 7 - 3 = __, and 7 - __ = 3).

2.11 The student will

- count, compare, and make change, using a collection of coins and one-dollar bills; and
- identify the correct usage of the cent symbol (¢), dollar symbol ($), and decimal point (.).

Measurement

2.12 The student will estimate and then use a ruler to make linear measurements to the nearest centimeter and inch, including the distance around a polygon (determine perimeter).

2.13 The student, given grid paper, will estimate and then count the number of square units needed to cover a given surface (determine area).

2.14 The student will estimate and then count the number of cubes in a rectangular box (determine volume).

2.15 The student will estimate and then determine weight/mass of familiar objects in pounds and/or kilograms, using a scale.

2.16 The student will tell and write time to the quarter hour, using analog and digital clocks.

2.17 The student will use actual measuring devices to compare metric and U.S. Customary units (cups, pints, quarts, gallons, and liters) for measuring liquid volume, using the concepts of more, less, and equivalent.

Geometry

2.18 The student will identify and describe a cube, rectangular solid, sphere, cylinder, and cone, according to the number and shape of faces, edges, bases, and corners.

2.19 The student will identify and create figures, symmetric along a line, using various concrete materials.

2.20 The student will compare and contrast plane and solid geometric shapes (circle/sphere, square/cube, triangle/pyramid, and rectangle/rectangular solid).

Probability and Statistics

2.21 The student will read, construct, and interpret a simple picture and bar graph.

2.22 The student, given a calendar, will determine past and future days of the week and identify specific dates.

2.23 The student will record data from experiments using spinners and colored tiles/cubes and use the data to predict which of two events is more likely to occur if the experiment is repeated.

Patterns, Functions, and Algebra

2.24 The student will complete a sequence of 10 or fewer consecutive whole numbers 0 though 999.

2.25 The student will identify, create, and extend a wide variety of patterns using symbols and objects.

2.26 The student will solve problems by completing a numerical sentence involving the basic facts for addition and subtraction. Examples include: 3 + __ = 7, or 9 - __ = 2. Students will create story problems using the numerical sentences.

Grade Three

The third-grade standards place emphasis on using a variety of methods to solve problems involving addition and subtraction of whole numbers. Students also will learn the multiplication and division facts through the nines table. Concrete materials will be used to introduce addition and subtraction with fractions and decimals and the concept of probability as chance. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Students also will identify real-life applications of the mathematical principles they are learning that can be applied to science and other disciplines they are studying.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

3.1 The student will read and write six-digit numerals and identify the place value for each digit.

3.2 The student will round a whole number, 999 or less, to the nearest ten and hundred.

3.3 The student will compare two whole numbers between 0 and 9,999, using symbols (>, <, or =) and words ("greater than," "less than," or "equal to").

3.4 The student will recognize and use the inverse relationships between addition/subtraction and multiplication/division to complete basic fact sentences. Students will use these relationships to solve problems such as $5 + 3 = 8$ and $8 - 3 =$ _____.

3.5 The student will name and write the fractions represented by drawings or concrete materials and represent a given fraction, using concrete materials and symbols.

3.6 The student will compare the numerical value of two fractions having like and unlike denominators, using concrete materials.

3.7 The student will read and write decimals expressed as tenths and hundredths, using concrete materials.

Computation and Estimation

3.8 The student will solve problems involving the sum or difference of two whole numbers, each 9,999 or less, with or without regrouping, using various computational methods, including calculators, paper and pencil, mental computation, and estimation.

3.9 The student will recall the multiplication and division facts through the nines table.

3.10 The student will create and solve problems that involve multiplication of two whole numbers, one factor 99 or less and the second factor 5 or less.

3.11 The student will add and subtract with proper fractions having like denominators of 10 or less, using concrete materials.

3.12 The student will add and subtract with decimals expressed as tenths, using concrete materials and paper and pencil.

3.13 The student will determine by counting the value of a collection of bills and coins up to $5.00, compare the value of the coins or bills, and make change.

Measurement

3.14 The student will estimate and then use actual measuring devices with metric and U.S. Customary units to measure

- length—inches, feet, yards, centimeters, and meters;
- liquid volume—cups, pints, quarts, gallons, and liters; and
- weight/mass—ounces, pounds, grams, and kilograms.

3.15 The student will tell time to the nearest five-minute interval and to the nearest minute, using analog and digital clocks.

3.16 The student will identify equivalent periods of time, including relationships among days, months, and years, as well as minutes and hours.

3.17 The student will read temperature, to the nearest degree, from a Celsius thermometer and a Fahrenheit thermometer. Real thermometers and physical models of thermometers will be used.

Geometry

3.18 The student will analyze plane and solid geometric figures (square, rectangle, triangle, cube, rectangular solid, and cylinder) and identify relevant properties, including the number of corners, square corners, the shape of faces, and edges.

3.19 The student will identify and draw representations of line segments and angles, using a ruler or straightedge.

3.20 The student, given appropriate drawings or models, will identify and describe congruent and symmetrical two-dimensional figures, using tracing procedures.

Probability and Statistics

3.21 The student, given grid paper, will collect data on a given topic of his/her choice and construct a bar graph showing the results. A title and key will be included.

3.22 The student will read and interpret data represented in bar and picture graphs.

3.23 The student will investigate and describe the concept of probability as chance, and list possible results of a given situation.

Patterns, Functions, and Algebra

3.24 The student will recognize and describe patterns formed using concrete objects, tables, and pictures and extend the pattern.

3.25 The student will analyze a given pattern formed using concrete objects and pictures and then create a pattern with the same attributes.

Grade Four

The fourth-grade standards place emphasis on division with whole numbers and solving problems involving addition and subtraction of fractions and decimals. Students will continue to learn and use the basic multiplication facts as they become proficient in multiplying larger numbers. Students also will refine their estimation skills for computations and measurements and investigate the relationships between and among points, lines, segments, and rays. Concrete materials will be used to solve problems involving perimeter, patterns, and probability. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Students also will identify real-life applications of the mathematical principles they are learning that can be applied to science and other disciplines they are studying.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

4.1 The student will

- identify, orally and in writing, the place value for each digit in a whole number expressed through millions;
- compare two whole numbers, expressed through millions, using symbols (>, <, or =); and
- round whole numbers expressed through millions to the nearest thousand, ten thousand, and hundred thousand.

4.2 The student will identify and represent equivalent fractions and relate fractions to decimals, using concrete objects.

4.3 The student will compare the numerical value of fractions having denominators of 12 or less.

4.4 The student will read, write, represent, and identify decimals expressed through thousandths, and round to the nearest tenth and hundredth, using concrete materials, drawings, calculators, and symbols.

Computation and Estimation

4.5 The student will create and solve problems involving addition and subtraction of money amounts using various computational methods, including calculators, paper and pencil, mental computation, and estimation.

4.6 The student will estimate whole-number sums and differences and describe the method of estimation. Students will refine estimates, using terms such as closer to, between, and a little more than.

4.7 The student will add and subtract whole numbers written in vertical and horizontal form, choosing appropriately between paper and pencil methods and calculators.

4.8 The student will find the product of two whole numbers when one factor has two digits or less and the other factor has three digits or less, using estimation and paper and pencil. For larger products (a two-digit numeral times a three-digit numeral), estimation and calculators will be used.

4.9 The student will estimate and find the quotient of two whole numbers given a one-digit divisor.

4.10 The student will

- add and subtract with fractions having like and unlike denominators of 12 or less and with decimals through thousandths, using concrete materials and paper and pencil; and
- solve problems involving addition and subtraction with fractions having like and unlike denominators of 12 or less and decimals expressed through thousandths.

Measurement

4.11 The student will

- estimate and measure weight/mass using actual measuring devices and express the results in both metric and U.S. Customary units, including ounces, pounds, grams, and kilograms; and
- estimate the conversion of ounces and grams and pounds and kilograms, using approximate comparisons (1 ounce is about 28 grams, or 1 gram is about the weight of a paper clip; 1 kilogram is a little more than 2 pounds).*

* *The intent of this standard is for students to make "ballpark" comparisons and not to memorize conversion factors between U.S. and metric units.*

4.12 The student will

- estimate and measure length using actual measuring devices and describe the results in both metric and U.S. Customary units, including part of an inch (1/2, 1/4, and 1/8), inches, feet, yards, millimeters, centimeters, and meters; and
- estimate the conversion of inches and centimeters, yards and meters, and miles and kilometers, using approximate comparisons (1 inch is about 2.5 centimeters, 1 meter is a little longer than 1 yard, 1 mile is slightly farther than 1.5 kilometers, or 1 kilometer is slightly farther than half a mile).*

* *The intent of this standard is for students to make "ballpark" comparisons and not to memorize conversion factors between U.S. and metric units.*

4.13 The student will

- estimate and measure liquid volume using actual measuring devices and using metric and U.S. Customary units, including cups, pints, quarts, gallons, milliliters, and liters; and
- estimate the conversion of quarts and liters, using approximate comparisons (1 quart is a little less than 1 liter, 1 liter is a little more than 1 quart).*

* *The intent of this standard is for students to make "ballpark" comparisons and not to memorize conversion factors between U.S. and metric units.*

4.14 The student will identify and describe situations representing the use of perimeter and will use measuring devices to find perimeter in both standard and nonstandard units of measure.

Geometry

4.15 The student will investigate and describe the relationships between and among points, lines, line segments, and rays.

4.16 The student will identify and draw representations of points, lines, line segments, rays, and angles, using a straightedge or ruler.

4.17 The student will identify lines which illustrate intersection, parallelism, and perpendicularity.

Probability and Statistics

4.18 The student will determine the probability of a given simple event, using concrete materials.

4.19 The student will collect, organize, and display data in line and bar graphs with scale increments of one or greater than one.

Patterns, Functions, and Algebra

4.20 The student will identify and locate missing whole numbers on a given number line.

4.21 The student will extend a given pattern, using concrete materials and tables.

4.22 The student will solve problems involving pattern identification and completion of patterns.

Grade Five

The fifth-grade standards place emphasis on developing proficiency in using whole numbers, fractions, and decimals to solve problems. Students will collect, display, and analyze data in a variety of ways and solve probability problems, using a sample space or tree diagram. Students also will solve problems involving area and perimeter, classify triangles, and plot points in the coordinate plane. Variables, expressions, and open sentences will be introduced. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Students also will identify real-life applications of the mathematical principles they are learning that can be applied to science and other disciplines they are studying.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

5.1 The student will read, write, and identify the place values of decimals through ten-thousandths.

5.2 The student will compare the value of two decimals through ten-thousandths using the symbols >, <, or =.

Computation and Estimation

5.3 The student will create and solve problems involving addition, subtraction, multiplication, and division of whole numbers, using paper and pencil, estimation, mental computation, and calculators.

5.4 The student will find the product of two numbers expressed as decimals through thousandths, using an appropriate method of calculation, including paper and pencil, estimation, mental computation, and calculators.

5.5 The student, given a dividend of four digits or less and a divisor of two digits or less, will find the quotient and remainder.

5.6 The student, given a dividend expressed as a decimal through ten-thousandths and a single-digit divisor, will find the quotient.

5.7 The student will add and subtract with fractions and mixed numerals, with and without regrouping, and express answers in simplest form. Problems will include like and unlike denominators, limited to 12 or less.

Measurement

5.8 The student will describe and determine the perimeter of a polygon and the area of a square, rectangle, and triangle, given the appropriate measures.

5.9 The student will identify and describe the diameter, radius, chord, and circumference of a circle.

5.10 The student will differentiate between area and perimeter and identify whether the application of the concept of perimeter or area is appropriate for a given situation.

5.11 The student will choose an appropriate measuring device and unit of measure to solve problems involving measurement of

- length—part of an inch (1/2, 1/4, and 1/8), inches, feet, yards, miles, millimeters, centimeters, meters, and kilometers;
- weight/mass—ounces, pounds, tons, grams, and kilograms;
- liquid volume—cups, pints, quarts, gallons, milliliters, and liters;
- area—square units; and
- temperature—Celsius and Fahrenheit units.

Problems also will include estimating the conversion of Celsius and Fahrenheit units relative to familiar situations (water freezes at 0°C and 32°F, water boils at 100°C and 212°F, normal body temperature is about 37°C and 98.6°F).

5.12 The student will determine an amount of elapsed time in hours and minutes within a 24-hour period.

Geometry

5.13 The student will classify angles and triangles as right, acute, or obtuse.

5.14 The student will measure and draw right, acute, and obtuse angles and triangles, using appropriate tools.

5.15 The student will identify the ordered pair for a point and locate the point for an ordered pair in the first quadrant of a coordinate plane.

Probability and Statistics

5.16 The student will

- solve problems involving the probability of a single event by using tree diagrams or by constructing a sample space representing all possible results; and
- create a problem statement involving probability based on information from a given problem situation. Students will not be required to solve the problem created.

5.17 The student will collect, organize, and display a set of numerical data in a variety of forms, given a problem situation, using bar graphs, stem-and-leaf plots, and line graphs.

5.18 The student will find the mean and mode of a set of data.

Patterns, Functions, and Algebra

5.19 The student will investigate, describe, and extend numerical and geometric patterns, including triangular numbers, perfect squares, patterns formed by powers of 10, and arithmetic sequences. Concrete materials and calculators will be used.

5.20 The student will

- investigate and describe the concept of variable;
- use a variable to represent a given verbal quantitative expression, involving one operation; and
- write an open sentence, using a variable to represent a given mathematical relationship.

5.21 The student will create a problem situation based on a given open sentence using a single variable.

Computer/Technology Standards by the End of Grade Five

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 5** include the following:

C/T5.1 The student will demonstrate a basic understanding of computer theory including bits, bytes, and binary logic.

C/T5.2 The student will develop basic technology skills.

- Develop a basic technology vocabulary that includes cursor, software, memory, disk drive, hard drive, and CD-ROM.
- Select and use technology appropriate to tasks.
- Develop basic keyboarding skills.
- Operate peripheral devices.
- Apply technologies to strategies for problem solving and critical thinking.

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C/T5.3 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information using databases, CD-ROMs, videodiscs, and telecommunications.
- Use electronic encyclopedias, almanacs, indexes, and catalogs.
- Use local and wide-area networks and modem-delivered services to access information from electronic databases.
- Describe advantages and disadvantages of various computer processing, storage, retrieval, and transmission techniques.

C/T5.4 The student will communicate through application software.

- Create a 1-2 page document using word processing skills, writing process steps, and publishing programs.
- Use simple computer graphics and integrate graphics into word-processed documents.
- Create simple databases and spreadsheets to manage information and create reports.
- Use local and worldwide network communication systems.

Grade Six

The sixth-grade standards place continued emphasis on the study of whole numbers, decimals, and fractions. Students will use ratios to compare data sets, make conversions within a given measurement system, make geometric constructions and classify three-dimensional figures, and solve linear equations in one variable. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as calculators and computers. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Students also will identify real-life applications of the mathematical principles they are learning that can be applied to science and other disciplines they are studying.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

6.1 The student will identify representations of a given percent and describe orally and in writing the equivalence relationship between fractions, decimals, and percents.

6.2 The student will describe and compare two sets of data using ratios and will use appropriate notations such as a/b, a to b, and a:b.

6.3 The student will explain orally and in writing the concepts of prime and composite numbers.

6.4 The student will compare and order whole numbers, fractions, and decimals, using concrete materials, drawings or pictures, and mathematical symbols.

6.5 The student will identify and represent integers on a number line.

Computation and Estimation

6.6 The student will

- solve problems that involve addition, subtraction, and/or multiplication with fractions and mixed numbers, with and without regrouping, that include like and unlike denominators of 12 or less and express their answers in simplest form; and
- find the quotient, given a dividend expressed as a decimal through thousandths and a divisor expressed as a decimal to thousandths with exactly one nonzero digit. For divisors with more than one nonzero digit, estimation and calculators will be used.

6.7 The student will use estimation strategies to solve multistep practical problems involving whole numbers, decimals, and fractions.

6.8 The student will solve multistep consumer application problems involving fractions and decimals and present data and conclusions in paragraphs, tables, or graphs.

Measurement

6.9 The student will compare and convert units of measures for length, weight/mass, and volume within the U.S. Customary system and within the metric system and estimate conversions between units in each system:*

- length—part of an inch (1/2, 1/4, and 1/8), inches, feet, yards, miles, millimeters, centimeters, meters, and kilometers;
- weight/mass—ounces, pounds, tons, grams, and kilograms;
- liquid volume—cups, pints, quarts, gallons, milliliters, and liters; and
- area—square units.

* *The intent of this standard is for students to make "ballpark" comparisons and not to memorize conversion factors between U.S. and metric units.*

6.10 The student will estimate and then determine length, weight/mass, area, and liquid volume/capacity, using standard and nonstandard units of measure.

6.11 The student will determine if a problem situation involving polygons of four sides or less represents the application of perimeter or area and apply the appropriate formula.

6.12 The student will create and solve problems by finding the circumference and/or area of a circle when given the diameter or radius. Using concrete materials or computer models, the student will derive approximations for pi from measurements for circumference and diameter.

6.13 The student will estimate angle measures using 45°, 90°, and 180° as referents and use the appropriate tools to measure the given angles.

Geometry

6.14 The student will identify, classify, and describe the characteristics of plane figures including similarities and differences.

6.15 The student will determine congruence of segments, angles, and polygons by direct comparison, given their attributes. Examples of noncongruent and congruent figures will be included.

6.16 The student will construct the perpendicular bisector of a line segment and an angle bisector, using a compass and straightedge.

6.17 The student will sketch, construct models, and classify rectangular prisms, cones, cylinders, and pyramids.

Probability and Statistics

6.18 The student, given a problem situation, will collect, analyze, display, and interpret data in a variety of graphical methods, including line, bar, and circle graphs and stem-and-leaf and box-and-whisker plots. Circle graphs will be limited to halves, fourths, and eighths.

6.19 The student will describe the mean, median, and mode as measures of central tendency and determine their meaning for a set of data.

6.20 The student will determine and interpret the probability of an event occurring from a given sample space.

Patterns, Functions, and Algebra

6.21 The student will recognize, describe, and extend a variety of numerical and geometric patterns.

6.22 The student will investigate and describe concepts of exponents, perfect squares, and square roots, using calculators to develop the exponential patterns. Patterns will include zero and negative exponents, which lead to the idea of scientific notation. Investigations will include the binary number system as an application of exponents and patterns.

6.23 The student will

- model and solve algebraic equations, using concrete materials; and
- solve one-step linear equations in one variable, involving whole number coefficients and positive rational solutions.

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Grade Seven

The seventh-grade standards place emphasis on solving problems involving consumer applications and proportional reasoning. The students will gain an understanding of the properties of real numbers, solve linear equations and inequalities, and use data analysis techniques to make inferences and predictions. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as fraction calculators, computers, laser discs, and videos. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Students also will identify real-life applications of the mathematical principles they are learning that can be applied to science and other disciplines they are studying.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

7.1 The student will compare, order, and determine equivalent relationships between fractions, decimals, and percents, including scientific notation.

7.2 The student will find common multiples and factors, including least common multiple and greatest common factor.

7.3 The student will simplify expressions by using order of operations, mental mathematics, and appropriate tools. Exponents will be included.

7.4 The student will explain orally and in writing the following properties of operations with real numbers:

- the commutative and associative properties for addition and multiplication;
- the distributive property;
- the additive and multiplicative identity properties;
- the additive and multiplicative inverse properties; and
- the multiplicative property of zero.

Computation and Estimation

7.5 The student will solve consumer application problems involving tips, discounts, sales tax, and simple interest, using whole numbers, fractions, decimals, and percents.

7.6 The student will

- solve practical problems involving basic operations with integers by formulating rules for operating with integers and using a number line to compute; and
- explain the need for integers, using examples from real-life situations.

7.7 The student will use proportions to solve practical problems, including scale drawings that contain whole numbers, fractions, decimals, and percents.

Measurement

7.8 The student, given appropriate dimensions, will estimate and find the area of polygons by subdividing them into rectangles and right triangles.

7.9 The student will investigate and solve problems involving the volume and surface area of rectangular prisms and cylinders, using concrete materials and practical situations to develop formulas.

Geometry

7.10 The student will compare and contrast the following quadrilaterals: a parallelogram, rectangle, square, rhombus, and trapezoid. Deductive reasoning and inference will be used to classify quadrilaterals.

7.11 The student will identify and draw the following polygons: pentagon, hexagon, heptagon, octagon, nonagon, and decagon.

7.12 The student will determine if geometric figures (quadrilaterals and triangles) are similar and write proportions to express the relationships between corresponding parts of similar figures.

7.13 The student will construct a three-dimensional model using cubes, given the top, side, and/or bottom views, and determine the volume and surface area of the model.

7.14 The student will inscribe equilateral triangles, squares, and hexagons in circles, using a compass and straightedge.

Probability and Statistics

7.15 The student will investigate and describe the difference between the probability of an event found through simulation versus the theoretical probability of that same event.

7.16 The student will make a sample space for selected experiments and represent it in the form of a list, chart, picture, or tree diagram.

7.17 The student will determine the probability of a given simple event and express that probability as a ratio, decimal, or a percent as appropriate for the given situation.

7.18 The student will identify and describe the number of possible arrangements of several objects, using a tree diagram or the Basic Counting Principle.

7.19 The student will create and solve problems involving the mean, median, mode, and range of a set of data.

7.20 The student will display data, using frequency distributions, line plots, stem-and-leaf plots, box-and-whisker plots, and scattergrams.

7.21 The student will make inferences and predictions based on the analysis of a set of data that the student(s) collect.

Patterns, Functions, and Algebra

7.22 The student will investigate and describe functional relationships, including the number of sides of a regular polygon and the sum of the measures of the interior angles.

7.23 The student will write verbal expressions/sentences as algebraic expressions/equations.

7.24 The student will use the following algebraic terms appropriately in written and/or oral expression: equation, inequality, variable, expression, term, coefficient, domain, and range.

7.25 The student will

- solve two-step linear equations and inequalities in one variable, using strategies involving inverse operations and integers; and
- solve practical problems requiring the solution of a two-step linear equation.

7.26 The student will identify and graph ordered pairs in the four quadrants of a coordinate plane.

Grade Eight

The eighth-grade standards are designed to prepare students for Algebra I. The standards contain both content that reviews or extends concepts and skills learned in previous grades and new content that prepares students for more abstract concepts in algebra. New concepts include solving multistep equations, graphing linear equations, applying transformations to geometric figures, and using matrices to organize and interpret data. While learning mathematics, students will be actively engaged, using concrete materials and appropriate technologies such as fraction calculators, computers, spreadsheets, laser discs, and videos. However, facility in the use of technology shall not be regarded as a substitute for a student's understanding of quantitative concepts and relationships or for proficiency in basic computations. Students will also identify real-life applications of the mathematical principles they are learning that can be applied to science and other disciplines they are studying.

Mathematics has its own language, and the acquisition of specialized vocabulary and language patterns is crucial to a student's understanding and appreciation of the subject. Students should be encouraged to use correctly the concepts, skills, symbols, and vocabulary identified in the following set of standards.

Problem solving has been integrated throughout the six content strands. The development of problem-solving skills should be a major goal of the mathematics program at every grade level. Instruction in the process of problem solving will need to be integrated early and continuously into each student's mathematics education. Students must be helped to develop a wide range of skills and strategies for solving a variety of problem types.

Number and Number Sense

8.1 The student will use proportions to solve scale-model problems with fractions and decimals.

8.2 The student will simplify numerical expressions involving exponents, using order of operations.

8.3 The student will describe orally and in writing the relationship between the subsets of the real number system.

Computation and Estimation

8.4 The student will solve practical problems involving whole numbers, integers, and rational numbers, including percents. Problems will be of varying complexities, involving real-life data.

8.5 The student will apply the order of operations to evaluate algebraic expressions for given replacement values of the variables.

8.6 The student, given a whole number from 0 to 100, will identify it as a perfect square or find the two consecutive whole numbers between which the square root lies.

Measurement

8.7 The student will verify by measuring and describe the relationships between vertical angles and angles that are supplementary and complementary.

8.8 The student will investigate and solve problems involving volume and surface area of cones and pyramids, using concrete materials and practical situations.

Geometry

8.9 The student will apply transformations (rotate or turn, reflect or flip, translate or slide, and dilate or scale) to geometric figures represented on graph paper. The student will identify applications of transformations such as tiling, fabric design, art, and scaling.

8.10 The student will describe, classify, and construct plane figures and solid figures, including prisms, pyramids, cylinders, and cones.

8.11 The student will verify the Pythagorean Theorem by measuring and then applying the Pythagorean Theorem to find the missing length of a side of a right triangle when the lengths of the other two sides are given.

Probability and Statistics

8.12 The student will analyze problem situations, such as games of chance, board games, or grading scales, and make predictions, using knowledge of probability.

8.13 The student will use information displayed in line, bar, circle, and picture graphs and histograms to make comparisons, predictions, and inferences.

8.14 The student will use a matrix to organize and describe data.

Patterns, Functions, and Algebra

8.15 The student will investigate and describe functional relationships, including the number of sides of a regular polygon and the maximum number of possible diagonals, expressing the algebraic concept of the number of diagonals of the nth-sided polygon.

8.16 The student will solve multistep equations in one variable.

8.17 The student will graph a linear equation in two variables on the coordinate plane, using a table of ordered pairs.

8.18 The student will describe and represent relations using tables, graphs, and rules.

8.19 The student will create and solve problems using proportions, formulas, and functions.

Computer/Technology Standards by the End of Grade Eight

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 8** include the following:

C/T8.1 The student will communicate through application software.

- Compose and edit a multipage document at the keyboard, using word processing skills and the writing process steps.
- Communicate with spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data.

- Communicate with databases by defining fields and entering data, sorting, and producing reports in various forms.
- Use advanced publishing software, graphics programs, and scanners to produce page layouts.
- Integrate databases, graphics, and spreadsheets into word-processed documents.

C/T8.2 The student will communicate through networks and telecommunication.

- Use local and worldwide network communication systems.
- Develop hypermedia "home page" documents that can be accessed by worldwide networks.

C/T8.3 The student will have a basic understanding of computer processing, storing, retrieval and transmission technologies and a practical appreciation of the relevant advantages and disadvantages of various processing, storage, retrieval, and transmission technologies.

C/T8.4 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information.
- Use electronic encyclopedias, almanacs, indexes, and catalogs to retrieve and select relevant information.
- Use laser discs with a computer in an interactive mode.
- Use local and wide-area networks and modem-delivered services to access and retrieve information from electronic databases.
- Use databases to perform research.

Algebra I

The standards below outline the content for a one-year course in Algebra I. All students are expected to achieve the Algebra I standards. When planning for instruction, consideration should be given to the student's cognitive level and readiness for dealing with abstract concepts. Students should be helped to make connections and to build relationships between algebra and arithmetic, geometry, and probability and statistics. Connections also should be made to other subject areas through practical applications. This approach to teaching algebra should help students attach meaning to the abstract concepts of algebra.

These standards require students to use algebra as a tool for representing and solving a variety of practical problems. Tables and graphs will be used to interpret algebraic expressions, equations, and inequalities and to analyze functions. Matrices will be used to organize and manipulate data.

Calculators, computers, spreadsheets, and graphing utilities (graphing calculators or computer graphing simulators) should be used as tools to assist in problem solving. Graphing utilities enhance the understanding of functions; they provide a powerful tool for solving and verifying solutions to equations and inequalities.

Throughout the course, students should be encouraged to talk about mathematics, to use the language and symbols of mathematics to communicate, to discuss problems and problem solving, and to develop their confidence in mathematics.

A.1 The student will solve linear equations and inequalities in one variable, solve literal equations (formulas) for a given variable and apply these skills to solve practical problems. Graphing calculators will be used to confirm algebraic solutions.

A.2 The student will represent verbal quantitative situations algebraically and evaluate these expressions for given replacement values of the variables. Students will choose an appropriate computational technique, such as mental mathematics, calculator, or paper and pencil.

A.3 The student will justify steps used in simplifying expressions and solving equations and inequalities. Justifications will include the use of concrete objects, pictorial representations, and the properties of real numbers.

A.4 The student will use matrices to organize and manipulate data, including matrix addition, subtraction, and scalar multiplication. Data will arise from business, industrial, and consumer situations.

A.5 The student will analyze a given set of data for the existence of a pattern, represent the pattern algebraically and graphically, if possible, and determine if the relation is a function.

A.6 The student will select, justify, and apply an appropriate technique to graph a linear function in two variables. Techniques will include slope-intercept, x- and y-intercepts, graphing by transformation, and the use of the graphing calculator.

A.7 The student will determine the slope of a line when given an equation of the line, the graph of the line, or two points on the line. Slope will be described as rate of change and will be positive, negative, zero, or undefined. The graphing calculator will be used to investigate the effect of changes in the slope on the graph of the line.

A.8 The student will write an equation of a line when given the graph of the line, two points on the line, or the slope and a point on the line.

A.9 The student will solve systems of two linear equations in two variables, both algebraically and graphically, and apply these techniques to solve practical problems. Graphing calculators will be used as both a primary tool of solution and to confirm an algebraic solution.

A.10 The student will apply the laws of exponents to perform operations on expressions with integral exponents, using scientific notation when appropriate.

A.11 The student will add, subtract, and multiply polynomials and divide polynomials with monomial divisors, using concrete objects, pictorial representations, and algebraic manipulations.

A.12 The student will factor completely first- and second-degree binomials and trinomials in one or two variables. The graphing calculator will be used as both a primary tool for factoring and for confirming an algebraic factorization.

A.13 The student will estimate square roots to the nearest tenth and use a calculator to compute decimal approximations of radicals.

A.14 The student will solve quadratic equations in one variable both algebraically and graphically. Graphing calculators will be used both as a primary tool in solving problems and to verify algebraic solutions.

A.15 The student will determine the domain and range of a relation given a graph or a set of ordered pairs and will identify the relations that are functions.

A.16 The student will, given a rule, find the values of a function for elements in its domain and locate the zeros of the function both algebraically and with a graphing calculator. The value of f(x) will be related to the ordinate on the graph.

A.17 The student will, given a set of data points, write an equation for a line of best fit, using the median fit method, and use the equation to make predictions.

A.18 The student will compare multiple one-variable data sets, using statistical techniques that include measures of central tendency, range, stem-and-leaf plots, and box-and-whisker graphs.

A.19 The student will analyze a relation to determine whether a direct or inverse variation exists and represent it algebraically and graphically, if possible.

Geometry

This course is designed for students who have successfully completed the standards for Algebra I. The course, among other things, includes the deductive axiomatic method of proof to justify theorems and to tell whether conclusions are valid. Methods of justification will include paragraph proofs, flow charts, two-column proofs, indirect proofs, coordinate proofs, and verbal arguments. A gradual development of formal proof is encouraged. Inductive and intuitive approaches also should be used.

This set of standards includes emphasis on two- and three-dimensional reasoning skills, coordinate and transformational geometry, and the use of geometric models to solve problems. A variety of applications and some general problem-solving techniques should be used to implement these standards, including algebraic skills. Calculators, computers, and graphing utilities (graphing calculators or computer graphing simulators) should be used by the student where feasible. Any technology that will enhance student learning should be used.

G.1 The student will construct and judge the validity of a logical argument consisting of a set of premises and a conclusion. This will include
- identifying the converse, inverse, and contrapositive of a conditional statement;
- translating a short verbal argument into symbolic form;
- diagramming arguments involving quantifiers (all, no, none, some), using Venn diagrams; and
- using valid forms of deductive reasoning, including the law of syllogism.

G.2 The student will use pictorial representations, including computer software and coordinate methods to solve problems involving symmetry and transformation. This will include
- using formulas for finding distance, midpoint, and slope;
- investigating and determining whether a figure is symmetric with respect to a line or a point; and
- determining whether a figure has been translated, reflected, or rotated.

G.3 The student will solve practical problems involving complementary, supplementary, and congruent angles that include vertical angles, angles formed when parallel lines are cut by a transversal, and angles in polygons.

G.4 The student will use the relationships between angles formed by two lines cut by a transversal to determine if two lines are parallel and verify, using algebraic and coordinate methods as well as deductive proofs.

G.5 The student will
- investigate and identify congruence and similarity relationships between triangles; and
- prove two triangles are congruent or similar given information in the form of a figure or statement, using algebraic and coordinate as well as deductive proofs.

G.6 The student, given information concerning the lengths of sides and/or measures of angles, will apply the triangle inequality properties to determine whether a triangle exists and to order sides and angles. These concepts will be considered in the context of practical situations.

G.7 The student will solve practical problems involving right triangles by using the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry. Calculators will be used to solve problems and find decimal approximations for the solutions.

G.8 The student will
- investigate and identify properties of quadrilaterals involving opposite sides and angles, consecutive sides and angles, and diagonals;
- prove these properties of quadrilaterals using algebraic and coordinate as well as deductive proofs; and
- use properties of quadrilaterals to solve practical problems.

G.9 The student will use measures of interior and exterior angles of polygons to solve problems. Tessellations and tiling problems will be used to make connections to art, construction, and nature.

G.10 The student will investigate and use the properties of angles, arcs, chords, tangents, and secants to solve problems involving circles. Problems will include finding the area of a sector and applications of architecture, art, and construction.

G.11 The student will construct, using a compass and straightedge, a line segment congruent to a given line segment, the bisector of a line segment, a perpendicular to a given line from a point not on the line, a perpendicular to a given line at a point on the line, the bisector of a given angle, and an angle congruent to a given angle.

G.12 The student will make a model of a three-dimensional figure from a two-dimensional drawing and make a two-dimensional representation of a three-dimensional object. Models and representations will include scale drawings, perspective drawings, blueprints, or computer simulations.

G.13 The student will use formulas for surface area and volume of three-dimensional objects to solve practical problems. Calculators will be used to find decimal approximations for results.

G.14 The student, given similar geometric objects, will use proportional reasoning to solve practical problems; investigate relationships between linear, square, and cubic measures; and describe how changes in one of the measures of the object affect the others.

G.15 The student will
- draw a system of vectors and find the resultant graphically, write the components of a vector as a column matrix, and find the resultant by matrix addition; and
- solve practical problems using a system of vectors.

Algebra II

The standards below outline the content for a one-year course in Algebra II. Students enrolled in Algebra II are assumed to have mastered those concepts outlined in the Algebra I standards. A thorough treatment of advanced algebraic concepts is provided through the study of functions, polynomials, rational expressions, complex numbers, matrices, and sequences and series. Emphasis should be placed on practical applications and modeling throughout the course of study. Oral and written communication concerning the language of algebra, logic of procedures, and interpretation of results also should permeate the course.

These standards include a transformational approach to graphing functions. Transformational graphing uses translation, reflection, dilation, and rotation to generate a "family of graphs" from a given graph and builds a strong connection between algebraic and graphic representations of functions. Students will vary the coefficients and constants of an equation, observe the changes in the graph of the equation, and make generalizations that can be applied to many graphs.

Graphing utilities (graphing calculators or computer graphing simulators) and spreadsheets will be used by students and teachers. Graphing utilities enhance the understanding of realistic applications through mathematical modeling and aid in the investigation and study of functions and their inverses. They also provide an effective tool for solving/verifying equations and inequalities. Any other available technology that will enhance student learning should be used.

AII.1 The student will identify field properties, axioms of equality and inequality, and properties of order that are valid for the set of real numbers and its subsets, complex numbers, and matrices.

AII.2 The student will add, subtract, multiply, divide, and simplify rational expressions, including complex fractions.

AII.3 The student will

- add, subtract, multiply, divide, and simplify radical expressions containing positive rational numbers and variables and expressions containing rational exponents; and
- write radical expressions as expressions containing rational exponents, and vice versa.

AII.4 The student will solve absolute value equations and inequalities graphically and algebraically. Graphing calculators will be used both as a primary method of solution and to verify algebraic solutions.

AII.5 The student will identify and factor completely polynomials representing the difference of squares, perfect square trinomials, the sum and difference of cubes, and general trinomials.

AII.6 The student will select, justify, and apply a technique to solve a quadratic equation over the set of complex numbers. Graphing calculators will be used for solving and confirming algebraic solutions.

AII.7 The student will solve equations containing rational expressions and equations containing radical expressions algebraically and graphically. Graphing calculators will be used for solving and confirming algebraic solutions.

AII.8 The student will recognize multiple representations of functions (linear, quadratic, absolute value, step, and exponential functions) and convert between a graph, a table, and symbolic form. A transformational approach to graphing will be employed through the use of graphing calculators.

AII.9 The student will find the domain, range, zeros and inverse of a function, the value of a function for a given element in its domain, and the composition of multiple functions. Functions will include those that have domains and ranges that are limited and/or discontinuous. The graphing calculator will be used as a tool to assist in investigation of functions, including exponential and logarithmic.

AII.10 The student will investigate and describe the relationships between the solution of an equation, zero of a function, x-intercept of a graph, and factors of a polynomial expression through the use of graphs.

AII.11 The student will use matrix multiplication to solve practical problems. Graphing calculators or computer programs with matrix capabilities will be used to find the product.

AII.12 The student will represent problem situations with a system of linear equations and solve the system using the inverse matrix method. Graphing calculators or computer programs with matrix capability will be used to perform computations.

AII.13 The student will solve systems of linear inequalities and linear programming problems and describe the results both orally and in writing. A graphing calculator will be used to facilitate solutions to linear programming problems.

AII.14 The student will solve nonlinear systems of equations, including linear-quadratic and quadratic-quadratic, algebraically and graphically. The graphing calculator will be used as a tool to visualize graphs and predict the number of solutions.

AII.15 The student will recognize the general shape of polynomial functions, locate the zeros, sketch the graphs, and verify graphical solutions algebraically. The graphing calculator will be used as a tool to investigate the shape and behavior of polynomial functions.

AII.16 The student will investigate and apply the properties of arithmetic and geometric sequences and series to solve problems, including writing the first n terms, finding the nth term, and evaluating summation formulas. Notation will include Σ and an.

AII.17 The student will perform operations on complex numbers and express the results in simplest form. Simplifying results will involve using patterns of the powers of i.

AII.18 The student will identify conic sections (circle, ellipse, parabola, and hyperbola) from his/her equations. Given the equations in (h, k) form, students will sketch graphs of conic sections, using transformations.

AII.19 The student will collect and analyze data to make predictions, write equations, and solve practical problems. Graphing calculators will be used to investigate scatterplots to determine the equation for a curve of best fit.

AII.20 The student will identify, create, and solve practical problems involving a combination of direct and inverse variations.

Trigonometry

The standards below outline the content for a one-semester course in trigonometry. A thorough treatment of trigonometry is provided through the study of trigonometric definitions, applications, graphing, and solving trigonometric equations and inequalities. Emphasis should be placed on using connections between right triangle ratios, trigonometric functions, and circular functions. In addition, applications and modeling should be included throughout the course of study. Emphasis should be placed on oral and written communication concerning the language of mathematics, logic of procedure, and interpretation of results. Students enrolled in trigonometry are assumed to have mastered those concepts outlined in the Algebra II standards.

Graphing utilities (graphing calculators or computer graphing simulators) will be used by students and teachers. Graphing utilities enhance the understanding of realistic applications through modeling and aid in the investigation of trigonometric functions and their inverses. They also provide a powerful tool for solving/verifying trigonometric equations and inequalities. Any other technology that will enhance student learning should be used if available.

T.1 The student will use the definitions of the six trigonometric functions to find the sine, cosine, tangent, cotangent, secant, and cosecant of an angle in standard position, given a point, other than the origin, on the terminal side of the angle. Circular function definitions will be connected with trigonometric function definitions.

T.2 The student, given the value of one trigonometric function, will find the values of the other trigonometric functions. Properties of the unit circle and definitions of circular functions will be applied.

T.3 The student will find the values of the trigonometric functions of the special angles and their related angles as found in the unit circle without the aid of a calculating utility. This will include converting radians to degrees and vice versa.

T.4 The student will use a calculator to find the value of any trigonometric function and inverse trigonometric function.

T.5 The student will verify basic trigonometric identities and make substitutions using the basic identities.

T.6 The student, given one of the six trigonometric functions in standard form (e.g., $y = A\sin(Bx + C) + D$, where A, B, C, and D are real numbers), will
- state the domain and the range of the function;
- determine the amplitude, period, phase shift, and vertical shift; and
- sketch the graph of the function by using transformations for at least a one-period interval.

The graphing calculator will be used to investigate the effect of changing A, B, C, and D on the graph of a trigonometric function.

T.7 The student will identify the domain and range of the inverse trigonometric functions and recognize the graph of these functions. Restrictions on the domains of the inverse trigonometric functions will be included.

T.8 The student will solve trigonometric equations that include both infinite solutions and restricted domain solutions and solve basic trigonometric inequalities. Graphing utilities will be used to solve equations, to check for reasonableness of results, and to verify algebraic solutions.

T.9 The student will identify, create, and solve practical problems involving triangles and vectors. Techniques will include using the trigonometric functions, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines.

Algebra II and Trigonometry

The standards for this combined course in Algebra II and Trigonometry include all of the standards listed for Algebra II and Trigonometry. This course is designed for advanced students who are capable of a more rigorous course at an accelerated pace. The standards listed for this course provide the foundation for students to pursue a sequence of advanced mathematical studies from Mathematical Analysis to Advanced Placement Calculus.

AII/T.1 The student will identify field properties, axioms of equality and inequality, and properties of order that are valid for the set of real numbers and its subsets, complex numbers, and matrices.

AII/T.2 The student will add, subtract, multiply, divide, and simplify rational expressions, including complex fractions.

AII/T.3 The student will
- add, subtract, multiply, divide, and simplify radical expressions containing positive rational numbers and variables and expressions containing rational exponents; and
- write radical expressions as expressions containing rational exponents and vice versa.

AII/T.4 The student will solve absolute value equations and inequalities graphically and algebraically. Graphing calculators will be used both as a primary method of solution and to verify algebraic solutions.

AII/T.5 The student will identify and factor completely polynomials representing the difference of squares, perfect square trinomials, the sum and difference of cubes, and general trinomials.

AII/T.6 The student will select, justify, and apply a technique to solve a quadratic equation over the set of complex numbers. Graphing calculators will be used for solving and confirming algebraic solutions.

AII/T.7 The student will solve equations containing rational expressions and equations containing radical expressions algebraically and graphically. Graphing calculators will be used both as a primary tool for solving and confirming algebraic solutions.

AII/T.8 The student will recognize multiple representations of functions (linear, quadratic, absolute value, step, and exponential functions) and convert between a graph, a table, and symbolic form. A transformational approach to graphing will be employed through the use of graphing calculators.

AII/T.9 The student will find the domain, range, zeros, and inverse of a function; the value of a function for a given element in its domain; and the composition of multiple functions. Functions will include those that have domains and ranges that are limited and/or discontinuous. The graphing calculator will be used as a tool to assist in investigation of functions, including exponential and logarithmic.

AII/T.10 The student will investigate and describe the relationships between the solution of an equation, zero of a function, x-intercept of a graph, and factors of a polynomial expression through the use of graphs.

AII/T.11 The student will use matrix multiplication to solve practical problems. Graphing calculators or computer programs with matrix capabilities will be used to find the product.

AII/T.12 The student will represent problem situations with a system of linear equations and solve the system, using the inverse matrix method. Graphing calculators or computer programs with matrix capability will be used to perform computations.

AII/T.13 The student will solve systems of linear inequalities and linear programming problems and describe the results both orally and in writing. A graphing calculator will be used to facilitate solutions to linear programming problems.

AII/T. 14 The student will solve nonlinear systems of equations, including linear-quadratic and quadratic-quadratic, algebraically and graphically. The graphing calculator will be used as a tool to visualize graphs and predict the number of solutions.

AII/T.15 The student will recognize the general shape of polynomial functions, locate the zeros, sketch the graphs, and verify graphical solutions algebraically. The graphing calculator will be used as a tool to investigate the shape and behavior of polynomial functions.

AII/T.16 The student will investigate and apply the properties of arithmetic and geometric sequences and series to solve problems, including writing the first n terms, finding the n^{th} term, and evaluating summation formulas. Notation will include $\sum$ and a_n.

AII/T.17 The student will perform operations on complex numbers and express the results in simplest form. Simplifying results will involve using patterns of the powers of *i*.

AII/T.18 The student will identify conic sections (circle, ellipse, parabola, and hyperbola) from his/her equations. Given the equations in (h, k) form, students will sketch graphs, using transformations.

AII/T.19 The student will collect and analyze data to make predictions, write equations, and solve practical problems. Graphing calculators will be used to investigate scatterplots to determine the equation for a curve of best fit.

AII/T.20 The student will solve practical problems involving a combination of direct and inverse variations.

AII/T.21 The student will use the definitions of the six trigonometric functions to find the sine, cosine, tangent, cotangent, secant, and cosecant of an angle in standard position, given a point, other than the origin, on the terminal side of the angle. Circular function definitions will be connected with trigonometric function definitions.

AII/T.22 The student, given the value of one trigonometric function, will find the values of the other trigonometric functions. Properties of the unit circle and definitions of circular functions will be applied.

AII/T.23 The student will find the values of the trigonometric functions of the special angles and their related angles as found in the unit circle without the aid of a calculating utility. This will include converting radians to degrees and vice versa.

AII/T.24 The student will use a calculator to find the value of any trigonometric function and inverse trigonometric function.

AII/T.25 The student will verify basic trigonometric identities and make substitutions using the basic identities.

AII/T.26 The student, given one of the six trigonometric functions in standard form (e.g., $y = A\sin(Bx + C) + D$, where A, B, C, and D are real numbers), will

- state the domain and the range of the function;
- determine the amplitude, period, phase shift, and vertical shift; and
- sketch the graph of the function by using transformations for at least a one-period interval.

The graphing calculator will be used to investigate the effect of changing A, B, C, and D on the graph of a trigonometric function.

AII/T.27 The student will identify the domain and range of the inverse trigonometric functions and recognize the graph of these functions. Restrictions on the domains of the inverse trigonometric functions will be included.

AII/T.28 The student will solve trigonometric equations that include both infinite solutions as well as restricted domain solutions and solve basic trigonometric inequalities. Graphing utilities will be used to solve equations, to check for reasonableness of results, and to verify algebraic solutions.

AII/T.29 The student will identify, create, and solve practical problems involving triangles and vectors. Techniques will include using the trigonometric functions, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines.

Mathematical Analysis

The standards below outline the content for a one-year course in Mathematical Analysis. Mathematical Analysis is intended not only to extend students' knowledge of function characteristics but also to introduce them to another mode of mathematical reasoning. Students enrolled in Mathematical Analysis are assumed to have mastered Algebra II concepts and have some exposure to trigonometry. The content of this course will serve as appropriate preparation for a calculus course.

Graphing utilities (graphing calculators or computer graphing simulators) will be used by students and teachers. Graphing utilities enhance the understanding of realistic applications through modeling and aid in the investigation of functions and their inverses. They also provide a powerful tool for solving and verifying equations and inequalities. Any other technology that will enhance student learning should be used if available.

MA.1 The student will investigate and identify the characteristics of polynomial and rational functions and use these to sketch the graphs of the functions. This will include determining zeros, upper and lower bounds, y-intercepts, symmetry, asymptotes, intervals for which the function is increasing or decreasing, and maximum or minimum points. Graphing utilities will be used to investigate and verify these characteristics.

MA.2 The student will perform operations, including composition and inversion of functions, and determine the domain and range of results. Continuity of functions and special functions such as absolute value, step functions, and piece-wise, will be included. Curve sketching and transformations will be included. Graphing utilities will be used to investigate and verify the graphs.

MA.3 The student will use graphs to investigate and describe the continuity of functions. The functions will include piece-wise-defined and step functions.

MA.4 The student will expand binomials having positive integral exponents through the use of the Binomial Theorem, the formula for combinations, and Pascal's Triangle.

MA.5 The student will solve problems involving arithmetic and geometric sequences and series. This will include finding the sum (sigma notation included) of finite and infinite convergent series that will lead to an intuitive approach to a limit.

MA.6 The student will apply the method of mathematical induction to prove formulas/statements.

MA.7 The student will find the limit of an algebraic function, if it exists, as the variable approaches either a finite number or infinity. A graphing utility will be used to verify intuitive reasoning, algebraic methods, and numerical substitution.

MA.8 The student will apply the techniques of translation and rotation of axes in the coordinate plane to graphing functions and conic sections. A graphing utility will be used to investigate and verify the graphs. Matrices will be used to represent transformations.

MA.9 The student will investigate and identify the characteristics of exponential and logarithmic functions in order to graph these functions and to solve equations and practical problems. This will include the role of e, natural and common logarithms, laws of exponents and logarithms, and the solution of logarithmic and exponential equations. Graphing utilities will be used to investigate and verify the graphs and solutions.

MA.10 The student will investigate and identify the characteristics of the graphs of polar equations using graphing utilities. This will include classification of polar equations, the effects of changes in the parameters in polar equations, conversion of complex numbers from rectangular form to polar form and vice versa, and the intersection of the graphs of polar equations.

MA.11 The student will perform operations with vectors in the coordinate plane and solve practical problems using vectors. This will include the following topics: operations of addition, subtraction, scalar multiplication, and inner (dot) product; norm of a vector; unit vector; graphing; properties; simple proofs; complex numbers (as vectors); and perpendicular components.

MA.12 The student will use parametric equations to model and solve application problems. Graphing utilities will be used to develop an understanding of the graph of parametric equations.

MA.13 The student will identify, create, and solve practical problems involving triangles and vectors. Techniques will include using the trigonometric functions, the Pythagorean Theorem, the Law of Sines, and the Law of Cosines.

Advanced Placement Calculus

This course is intended for students who have a thorough knowledge of analytic geometry and elementary functions in addition to college preparatory algebra, geometry, and trigonometry. The purpose of the course is to prepare the student for advanced placement in college calculus. These standards incorporate the 1995-1996 College Board Advanced Placement Course Description Syllabus. Teachers should update course content as changes occur in future College Board publications.

As mandated by The College Board, graphing calculators will be required for this course. Computers should be used where feasible by the student and by the teacher. Any technology that will enhance student learning should be used if available. Instructional activities that engage students in solving application problems of varying complexities are encouraged.

APC.1 The student will define and apply the properties of elementary functions, including algebraic, trigonometric, exponential, and composite functions and their inverses, and graph these functions using a graphing calculator. Properties of functions will include domains, ranges, combinations, odd, even, periodicity, symmetry, asymptotes, zeros, upper and lower bounds, and intervals where the function is increasing or decreasing.

APC.2 The student will define and apply the properties of limits of functions. This will include limits of a constant, sum, product, quotient, one-sided limits, limits at infinity, infinite limits, and nonexistent limits.

* AP Calculus BC will include the rigorous definitions of a limit.

APC.3 The student will state the definition of continuity and determine where a function is continuous or discontinuous. This will include

- continuity at a point;
- continuity over a closed interval;
- application of the Intermediate Value Theorem; and
- graphical interpretation of continuity and discontinuity.

APC.4 The student will find the derivative of an algebraic function by using the definition of a derivative. This will include investigating and describing the relationship between differentiability and continuity.

APC.5 The student will apply formulas to find the derivative of algebraic, trigonometric, exponential, and logarithmic functions and their inverses.

APC.6 The student will apply formulas to find the derivative of the sum, product, quotient, inverse, and composite (chain rule) of elementary functions.

APC.7 The student will find the derivative of an implicitly defined function.

APC.8 The student will find the higher order derivatives of algebraic, trigonometric, exponential, and logarithmic functions.

APC.9 The student will use logarithmic differentiation as a technique to differentiate nonlogarithmic functions.

APC.10 The student will state (without proof) the Mean Value Theorem for derivatives and apply it both algebraically and graphically.

APC.11 The student will use l'Hopital's rule to find the limit of functions whose limits yield the indeterminate forms:

$$\frac{0}{0} \quad \text{and} \quad \frac{\infty}{\infty}$$

* For AP Calculus BC, these functions will also include functions whose limits yield the indeterminate forms:

$0 \cdot \infty$, 1^{∞}, ∞^{∞}, and $\infty - \infty$

APC.12 The student will apply the derivative to solve problems, including tangent and normal lines to a curve, curve sketching, velocity, acceleration, related rates of change, Newton's method, differentials and linear approximations, and optimization problems.

APC.13 The student will find the indefinite integral of algebraic, exponential, logarithmic, and trigonometric functions. The special integration techniques of substitution (change of variables) and integration by parts will be included.

*AP Calculus BC will also include integration by trigonometric substitution and integration by partial fractions (only linear factors in the denominator).

APC.14 The student will identify the properties of the definite integral. This will include the Fundamental

Theorem of Calculus and the definite integral as an area and as a limit of a sum as well as the fundamental theorem:

$$\frac{d}{d(x)} \int_a^x f(t)\, d(t) = f(x)$$

* AP Calculus BC will include composite functions defined by integrals, e.g.,

$$f(x) = \int_0^{x^2} e^{-t^2}\, d(t)$$

APC.15 The student will apply the definite integral to solve problems. These problems will include finding distance traveled on a line and velocity from acceleration with initial conditions, growth and decay problems, solutions of separable differential equations, the average value of a function, area between curves, volumes of solids of revolution about the axes or lines parallel to the axes using disc/washer and shell methods, and volumes of solids with known cross-sectional areas.

*AP Calculus BC will also include areas bounded by polar curves.

APC.16 The student will compute an approximate value for a definite integral. This will include numerical calculations using Riemann Sums and the Trapezoidal Rule.

*AP Calculus BC will also utilize Simpson's Rule.

*APC.17 The student will find the derivatives of vector functions and parametrically defined functions and use them to solve problems. The problems will include tangent and normal lines to parametrically defined curves, velocity and acceleration, and velocity and acceleration vectors for motion on a plane curve.

*APC.18 The student will use integration to solve problems. This will include areas bounded by polar curves, length of a path (including parametric curves), work (Hooke's law), and improper integrals.

*APC. 19 The student will define and test for convergence of a series of real numbers and of functions. This will include geometric series, comparison (including limit comparison), ratio, root, and integral tests, absolute and conditional convergence, alternating series and error approximation, and p-series.

*APC. 20 The student will define, restate, and apply power series. This will include addition, substitution, term-by-term differentiation and integration, interval of convergence, Taylor's series, Maclaurin series expansions, and Taylor polynomials with remainder and Lagrange error approximation.

* For those students who are enrolled in AP Calculus BC.

Computer Mathematics

This Computer Mathematics course is intended to provide students with experiences in using the computer to solve problems which can be set up as mathematical models. Students who successfully complete the standards for this course may earn high school mathematics credit. It is recognized that many students will gain computer skills in other mathematics courses or in a separate curriculum outside of mathematics and prior to high school. In such cases, the standards indicated by an asterisk (*) should be included in the student's course of study and treated as a review for those students who enroll in Computer Mathematics.

Even though computer ideas should be introduced in the context of mathematical concepts, problem solving per se should be developed in the most general sense, making the techniques applicable by students in many other environments. Strategies include defining the problem; developing, refining, and implementing a plan; and testing and revising the solution. Programming, ranging from simple programs involving only a few lines to complex programs involving subprograms, should permeate the entire course.

These standards identify fundamental principles and concepts in the field of computer science. Students will develop and refine skills in logic, organization, and precise expression that will enhance learning in other disciplines.

The standards that follow are separated into two groups: those related to programming concepts—Standards 1 through 21—and those dealing with mathematical applications—Standards 22 and 24. This separation is not intended to suggest that they be treated separately in the instructional program. Programming concepts, problem-solving strategies, and mathematical applications should be integrated throughout the course.

*COM.1 The student will describe the program development cycle: defining the problem, planning a solution, carrying out the plan, debugging the program, and providing program documentation.

*COM.2 The student will write program specifications that define the constraints of a given problem. These specifications include descriptions of pre-conditions, post-conditions, the desired output, analysis of the available input, and an indication as to whether or not the program is solvable under the given conditions.

*COM.3 The student will design a step-by-step plan (algorithm) to solve a given problem. The plan will be in the form of a program flowchart, pseudo code, a hierarchy chart and/or data flow diagram.

*COM.4 The student will use operating system commands, which include creating a new file, opening an existing file, saving a file, making a printed copy (hard copy) of the file, and executing a program.

*COM.5 The student will divide a given problem into manageable sections (modules) by task and implement the solution. The modules will include an appropriate user-defined function, subroutines, and procedures. Enrichment topics can include user-defined libraries (units) and object-oriented programming.

*COM.6 The student will design and implement the input phase of a program, which will include designing screen layout and getting information into the program by way of user interaction, data statements (BASIC), and/or file input. The input phase also will include methods of filtering out invalid data (error trapping).

*COM.7 The student will design and implement the output phase of a computer program, which will include designing output layout, accessing a variety of output devices, using output statements, and labeling results.

COM.8 The student will design and implement computer graphics, which will include topics appropriate for the available programming environment as well as student background. Students will use graphics as an end in itself, as an enhancement to other output, and as a vehicle for reinforcing programming techniques.

COM.9 The student will define simple variable data types that include integer, real (fixed and scientific notation), character, string, and Boolean.

COM.10 The student will use appropriate variable data types, including integer, real (fixed and scientific notation), character, string, and Boolean. This will also include variables representing structured data types.

*COM.11 The student will describe the way the computer stores, accesses, and processes variables, including the following topics: the use of variables versus constants, variables addresses, pointers, parameter passing, scope of variables, and local versus global variables. This will also include use of terminology, including memory, CPU, RAM, ROM, baud, byte, bits, floppy disc, and hard drive.

COM.12 The student will translate a mathematical expression into a computer statement, which involves writing assignment statements and using the order of operations.

COM.13 The student will select and implement built-in (library) functions in processing data, which include trigonometric functions, absolute value functions, random number functions, end of line, end of file, and string.

COM.14 The student will implement conditional statements that include if/then, if/then/else, case statements, and Boolean logic.

COM.15 The student will implement a loop, including iterative loops, pretest loops, and post-test loops. Other topics will include single entry point, single exit point, preconditions, post-conditions and loop invariance.

*COM.16 The student will select and implement appropriate data structures, including arrays (one-dimensional and/or multidimensional), files, and records. Implementation will include creating the data structure, putting information into the structure, and retrieving information from the structure.

*COM.17 The student will implement pre-existing algorithms, including sort routines, search routines, and animation routines.

COM.18 The student will test a program using an appropriate set of data. The set of test data should be appropriate and complete for the type of program being tested.

COM.19 The student will debug a program using appropriate techniques (e.g., appropriately placed controlled breaks, the printing of intermediate results, and other debugging tools available in the programming environment), and identify the difference between syntax errors and logic errors.

COM.20 The student will properly document a program including the preconditions and post-conditions of program segments, input/output specifications, the step-by-step plan, the test data, a sample run, and the program listing with appropriately placed comments.

COM.21 The student will design, write, test, debug, and document a complete structured program which requires the synthesis of many of the concepts contained in previous standards.

*COM.22 The student will solve practical consumer problems that involve analyzing and interpreting graphs, charts, and/or tables.

COM.23 The student will solve mathematical problems using formulas, equations, and functions. Problems will include those related to geometry, business, and leisure (e.g., sports and recreational activities).

COM.24 The student will solve probability, data analysis, and statistical problems.

Science Standards of Learning

for Virginia Public Schools

Science
Standards of Learning

Goals

The purposes of scientific investigation and discovery are to satisfy humankind's quest for knowledge and understanding and to preserve and enhance the quality of the human experience. Therefore, as a result of science instruction, students will be able to:

1. Develop and use an experimental design in scientific inquiry
2. Use the language of science to communicate understanding
3. Investigate phenomena using technology
4. Apply scientific concepts, skills, and processes to everyday experiences
5. Experience the richness and excitement of scientific discovery of the natural world through the historical and collaborative quest for knowledge and understanding
6. Make informed decisions regarding contemporary issues taking into account the following:
   - public policy and legislation
   - economic costs/benefits
   - validation from scientific data and the use of scientific reasoning and logic
   - respect for living things
   - personal responsibility
   - history of scientific discovery
7. Develop scientific dispositions and habits of mind including:
   - curiosity
   - demand for verification
   - respect for logic and rational thinking
   - consideration of premises and consequences
   - respect for historical contributions
   - attention to accuracy and precision
   - patience and persistence
8. Explore science-related careers and interests.

K-12 Safety

In implementing the Science Standards of Learning, students must know how to follow safety guidelines, demonstrate appropriate laboratory safety techniques, and use equipment safely while working individually and in groups.

Safety must be given the highest priority in implementing the K-12 instructional program for science. Correct and safe techniques, as well as wise selection of experiments, resources, materials, and field experiences appropriate to age levels, must be carefully considered with regard to the safety precautions for every instructional activity. Safe science classrooms require thorough planning, careful management, and constant monitoring of student activities. Class enrollment should not exceed the designed capacity of the room.

Teachers must be knowledgeable of the properties, use, and proper disposal of all chemicals that may be judged as hazardous prior to their use in an instructional activity. Such information is referenced through the MSDS forms (Materials Safety Data Sheets). The identified precautions involving the use of goggles, gloves, aprons, and fume hoods must be followed as prescribed.

While no comprehensive list exists to cover all situations, the following should be reviewed to avoid potential safety problems. Appropriate safety procedures should be used in the following situations:

- Observing wildlife; handling living and preserved organisms; and contact with natural hazards such as poison ivy, ticks, mushrooms, insects, spiders, and snakes

- Field activities in, near, or over bodies of water
- Handling of glass tubing, sharp objects, glassware, and labware
- Natural gas burners, bunsen burners, and other sources of flame/heat
- Hazards associated with direct sunlight (sunburn and eye damage)
- Use of extreme temperatures and cryogenic materials
- Hazardous chemicals including toxins, carcinogens, flammable and explosive materials
- Acid/base neutralization reactions/dilutions
- Production of toxic gases or situations where high pressures are generated
- Biological cultures, their appropriate disposal, and recombinant DNA
- Power equipment/motors
- High voltage/exposed wiring
- Laser beam, UV, and other radiation.

The use of human body fluids or tissues is generally prohibited for classroom lab activities. Further guidance from the following sources may be taken into account:

- OSHA (Occupational Safety and Health Administration)
- ISEF (International Science and Engineering Fair Rules)
- Public health departments and local school division protocols.

The Role of Instructional Technology in Science Education

The use of current and emerging technologies is essential to the K-12 science instructional program.

Specifically, technology must

- Assist in improving every student's functional literacy. This includes improved communication through reading/information retrieval (the use of telecommunications), writing (word processing), organization and analysis of data (databases, spreadsheets, and graphics programs), selling one's idea (presentation software), and resource management (project management software).
- Be readily available and used regularly as an integral and ongoing part in the delivery and assessment of instruction.
- Include instrumentation oriented toward the instruction and learning of science concepts, skills, and processes. Technology, however, should not be limited to traditional instruments of science such as microscopes, labware, and data-collecting apparatus but should also include computers, robotics, interactive-optical laser discs, video-microscopes, graphing calculators, CD-ROMs, probeware, on-line telecommunication, software and appropriate hardware, as well as other emerging technologies.
- Be reflected in the "instructional strategies" generally developed at the local school division level.

In most cases, the application of technology in science should remain "transparent" unless it is the actual focus of the instruction. One must expect students to "do as a scientist does" and not simply hear about science if they are truly expected to explore, explain, and apply scientific concepts, skills, and processes.

As computer/technology skills are essential components of every student's education, it is important that these skills are a shared responsibility of teachers of all disciplines and grade levels. Please note the computer/technology standards following the grade five and the physical science standards respectively.

Investigate and Understand

Many of the standards in the Science Standards of Learning begin with the phrase "Students will investigate and understand." This phrase was chosen to communicate the range of **rigorous science skills** and **knowledge** levels embedded in each standard. Limiting a standard to one observable behavior such as "describe" or "explain" would have narrowed the interpretation of what was intended to be a rich, highly rigorous, and inclusive content standard.

"Investigate" refers to scientific methodology and implies systematic use of the following inquiry skills:

- Observing
- Classifying and sequencing
- Communicating
- Measuring
- Predicting
- Hypothesizing
- Inferring
- Defining, controlling, and manipulating variables in experimentation

- Designing, constructing, and interpreting models
- Interpreting, analyzing, and evaluating data.

"Understand" refers to various levels of knowledge application. In the Science Standards of Learning these knowledge levels include the ability to

- **Recall** or **recognize** important information, key definitions, terminology, and facts
- **Explain** the information in one's own words, comprehend how the information is related to other key facts, and suggest additional interpretations of its meaning or importance
- **Apply** the facts and principles to new problems or situations, recognizing what information is required for a particular situation, explaining new phenomena with the information, and determining when there are exceptions
- **Analyze** the underlying details of important facts and principles, recognizing the key relations and patterns that are not always readily visible
- **Arrange** and **combine** important information, facts, and principles to produce a new idea, plan, procedure, or product
- **Make judgments** about information in terms of accuracy, precision, consistency, or effectiveness.

Therefore, the use of "investigate and understand" allows each content standard to become the basis for a broad range of teaching objectives, which the local school division will develop and refine to meet the intent of the Science Standards of Learning.

Kindergarten

The kindergarten standards stress the use of basic science skills to explore common materials, objects, and living things. Emphasis is placed on using the senses to gather information. Students are expected to develop skills in posing simple questions, measuring, sorting, classifying, and communicating information about the natural world. The science skills are an important focus as students learn about life processes and properties of familiar materials such as magnets and water. Through phenomena including shadows, patterns of weather, and plant growth, students are introduced to the concept of change. The significance of natural resources and conservation is introduced in the kindergarten standards.

Scientific Investigation, Reasoning, and Logic

K.1 The student will conduct investigations in which

- basic properties of objects are identified by direct observation;
- observations are made from multiple positions to achieve different perspectives;
- a set of objects is sequenced according to size;
- a set of objects is separated into two groups based on a single physical attribute;
- picture graphs are constructed using 10 or fewer units;
- nonstandard units are used to measure common objects;
- an unseen member in a sequence of objects is predicted;
- a question is developed from one or more observations;
- objects are described both pictorially and verbally; and
- unusual or unexpected results in an activity are recognized.

K.2 The student will investigate and understand that humans have senses including sight, smell, hearing, touch, and taste. Senses allow one to seek, find, take in, and react or respond to information in order to learn about one's surroundings. Key concepts include

- five senses (taste, touch, smell, hearing, and sight);
- sensing organs associated with each of the senses (eyes, ears, nose, tongue, and skin); and
- sensory descriptors (sweet, sour, bitter, salty, rough, smooth, hard, soft, cold, warm, hot, loud, soft, high, low, bright, dull).

Force, Motion, and Energy

K.3 The student will investigate and understand that magnets have an effect on some materials, make some things move without touching them, and have useful applications. Key concepts include

- attraction/nonattraction, push/pull, attract/repel, and metal/nonmetal; and
- useful applications (refrigerator magnet, can opener, magnetized screwdriver).

Matter

K.4 The student will investigate and understand that objects can be described in terms of their physical properties. Key concepts include

- the eight basic colors;
- shapes (circle, triangle, square) and forms (flexible, stiff, straight, curved);
- textures and feel (rough, smooth, hard, soft);
- relative size and weight (big, little, large, small, heavy, light, wide, thin, long, short); and
- position and speed (over, under, in, out, above, below, left, right, fast, slow).

K.5 The student will investigate and understand that water has properties that can be observed and tested. Key concepts include

- water occurs in different forms (solid, liquid, gas);
- the natural flow of water is downhill; and
- some materials float in water while others sink.

Life Processes

K.6 The student will investigate and understand basic needs and life processes of plants and animals. Key concepts include

- living things change as they grow and need food, water, and air to survive;
- plants and animals live and die (go through a life cycle); and
- offspring of plants and animals are similar but not identical to their parents and one another.

Interrelationships in Earth/Space Systems

K.7 The student will investigate and understand that shadows occur when light is blocked by an object. Key concepts include

- shadows occur in nature when sunlight is blocked by an object; and
- shadows can be produced by blocking artificial light sources.

Earth Patterns, Cycles, and Change

K.8 The student will investigate and understand simple patterns in his/her daily life. Key concepts include

- weather observations;
- the shapes and forms of many common natural objects including seeds, cones, and leaves;
- animal and plant growth; and
- home and school routines.

K.9 The student will investigate and understand that change occurs over time, and rates may be fast or slow. Key concepts include

- natural and human-made things may change over time; and
- changes can be noted and measured.

Resources

K.10 The student will investigate and understand that materials can be reused, recycled, and conserved. Key concepts include

- identifying materials and objects that can be used over and over again;
- describing everyday materials that can be recycled; and
- explaining how to conserve water and energy at home and in school.

Grade One

The first-grade standards continue to stress basic science skills in understanding familiar objects and events. Students are expected to begin conducting simple experiments and be responsible for some of the planning. Students are introduced to the concept of classifying plants and animals based on simple characteristics. Emphasis is placed on the relationships among objects and their interactions with one another. Students are expected to know the

basic relationships between the sun and Earth and between seasonal changes and plant and animal activities. Students also will begin to develop an understanding of moving objects, simple solutions, and important natural resources.

Scientific Investigation, Reasoning, and Logic

1.1 The student will plan and conduct investigations in which

- differences in physical properties are observed using the senses and simple instruments to enhance observations (magnifying glass);
- objects or events are classified and arranged according to attributes or properties;
- observations and data are communicated orally and with simple graphs, pictures, written statements, and numbers;
- length, mass, and volume are measured using standard and nonstandard units;
- inferences are made and conclusions are drawn about familiar objects and events;
- predictions are based on patterns of observation rather than random guesses; and
- simple experiments are conducted to answer questions.

Force, Motion, and Energy

1.2 The student will investigate and understand that moving objects exhibit different kinds of motion. Key concepts include

- objects may have straight, circular, and back and forth motions;
- objects vibrate;
- pushes or pulls can change the movement of an object; and
- the motion of objects may be observed in toys and in playground activities.

Matter

1.3 The student will investigate and understand how different common materials interact with water. Key concepts include

- some common liquids (vinegar) mix with water, others (oil) will not;
- some everyday solids (baking soda, powdered drink mix, sugar, salt) will dissolve, others (sand, soil, rocks) will not; and
- some substances will dissolve easily in hot water rather than cold water.

Life Processes

1.4 The student will investigate and understand that plants have life needs and functional parts and can be classified according to certain characteristics. Key concepts include

- needs (food, air, water, light, and a place to grow);
- parts (seeds, roots, stems, leaves, blossom, fruit); and
- characteristics: edible/nonedible, flowering/nonflowering, evergreen/deciduous.

1.5 The student will investigate and understand that animals, including people, have life needs and specific physical characteristics and can be classified according to certain characteristics. Key concepts include

- life needs (air, food, water, and a suitable place to live);
- physical characteristics (body coverings, body shape, appendages, and methods of movement); and
- characteristics (wild/tame, water homes/land homes).

Interrelationships in Earth/Space Systems

1.6 The student will investigate and understand the basic relationships between the sun and the Earth. Key concepts include

- the sun is the source of heat and light that warms the land, air, and water; and
- night and day are caused by the rotation of the Earth.

Earth Patterns, Cycles, and Change

1.7 The student will investigate and understand the relationship of seasonal change and weather to the activities and life processes of plants and animals. Key concepts include how temperature, light, and precipitation bring about changes in

- plants (growth, budding, falling leaves, wilting);
- animals (behaviors, hibernation, migration, body covering, habitat); and
- people (dress, recreation, work).

Resources

1.8 The student will investigate and understand that natural resources are limited. Key concepts include

- identification of natural resources (plants and animals, water, air, land, minerals, forests, and soil);
- factors that affect air and water quality;

- recycling, reusing, and reducing consumption of natural resources; and
- use of land as parks and recreational facilities.

Grade Two

The second-grade standards continue to focus on using a broad range of science skills in understanding the natural world. Making detailed observations, drawing conclusions, and recognizing unusual or unexpected data are skills needed to be able to use and validate information. Measurement in both English and metric units is stressed. The idea of living systems is introduced through habitats and the interdependence of living and nonliving things. The concept of change is explored in states of matter, life cycles, weather patterns, and seasonal effects on plants and animals.

Scientific Investigation, Reasoning, and Logic

2.1 The student will plan and conduct investigations in which

- observations are repeated to improve accuracy;
- two or more attributes are used to classify items;
- pictures and bar graphs are constructed using numbered axes;
- linear, volume, mass, and temperature measurements are made in metric (centimeters, meters, liters, degrees Celsius, grams, kilograms) and standard English units (inches, feet, yards, pints, quarts, gallons, degrees Fahrenheit, ounces, pounds);
- observation is differentiated from personal interpretation, and conclusions are drawn based on observations;
- simple physical models are constructed;
- conditions that influence a change are defined; and
- unexpected or unusual quantitative data are recognized.

Force, Motion, and Energy

2.2 The student will investigate and understand that natural and artificial magnets have certain characteristics and attract specific types of metals. Key concepts include

- magnetism, iron, magnetic/nonmagnetic, opposites, poles, attract/repel; and
- important applications including the magnetic compass.

Matter

2.3 The student will investigate and understand basic properties of solids, liquids, and gases. Key concepts include

- mass and volume; and
- processes involved with changes in matter from one state to another (condensation, evaporation, melting, freezing, expanding, and contracting).

Life Processes

2.4 The student will investigate and understand that plants and animals go through a series of orderly changes in their life cycles. Key concepts include

- some animals (frogs and butterflies) go through distinct stages during their lives while others generally resemble their parents; and
- flowering plants undergo many changes from the formation of the flower to the development of the fruit.

Living Systems

2.5 The student will investigate and understand that living things are part of a system. Key concepts include

- living organisms are interdependent with their living and nonliving surroundings; and
- habitats change over time due to many influences.

Interrelationships in Earth/Space Systems

2.6 The student will investigate and understand basic types and patterns of weather. Key concepts include

- temperature, wind, condensation, precipitation, drought, flood, and storms; and
- the uses and importance of measuring and recording weather data.

Earth Patterns, Cycles, and Change

2.7 The student will investigate and understand that weather and seasonal changes affect plants, animals, and their surroundings. Key concepts include

- effects on growth and behavior of living things (migration, estivation, hibernation, camouflage, adaptation, dormancy); and
- weathering and erosion of the land surface.

Resources

2.8 The student will investigate and understand that plants produce oxygen and food, are a source of useful products, and provide benefits in nature. Key concepts include

- important plant products (fiber, cotton, oil, spices, lumber, rubber, medicines, and paper);
- the availability of plant products affects the development of a geographic area; and
- plants provide homes and food for many animals and prevent soil from washing away.

Grade Three

The third-grade standards place increasing emphasis on conducting investigations. Students are expected to be able to develop questions, formulate simple hypotheses, make predictions, gather data, and use the metric system with greater precision. Using information to make inferences and draw conclusions becomes more important. In the area of physical science, the standards focus on simple machines, energy, and a basic understanding of matter. Behavioral and physical adaptations are examined in relation to the life needs of animals. The notion of living systems is further explored in aquatic and terrestrial food chains and diversity in environments. Patterns in the natural world are demonstrated in terms of the phases of the moon, tides, seasonal changes, the water cycle, and animal life cycles. Geological concepts are introduced through the investigation of the components of soil.

Scientific Investigation, Reasoning, and Logic

3.1 The student will plan and conduct investigations in which

- questions are developed to formulate hypotheses;
- predictions and observations are made;
- data are gathered, charted, and graphed;
- objects with similar characteristics are classified into at least two sets and two subsets;
- inferences are made and conclusions are drawn;
- natural events are sequenced chronologically;
- length is measured to the nearest centimeter;
- mass is measured to the nearest gram;
- volume is measured to the nearest milliliter and liter;
- temperature is measured to the nearest degree Celsius; and
- time is measured to the nearest minute.

Force, Motion, and Energy

3.2 The student will investigate and understand simple machines and their uses. Key concepts include

- types of simple machines (lever, screw, pulley, wheel and axle, inclined plane, and wedge);
- how simple machines function; and
- examples of simple machines found in the school, home, and work environment.

Matter

3.3 The student will investigate and understand that objects can be described in terms of the materials they are made of and their physical properties. Key concepts include

- objects are made of smaller parts;
- materials are composed of parts that are too small to be seen without magnification; and
- physical properties remain the same as the material is reduced in size.

Life Processes

3.4 The student will investigate and understand that behavioral and physical adaptations allow animals to respond to life needs. Key concepts include

- methods of gathering and storing food, finding shelter, defending themselves, and rearing young; and
- hibernation, migration, camouflage, mimicry, instinct, and learned behavior.

Living Systems

3.5 The student will investigate and understand relationships among organisms in aquatic and terrestrial food chains. Key concepts include
- producer, consumer, decomposer;
- herbivore, carnivore, omnivore; and
- predator—prey.

3.6 The student will investigate and understand that environments support a diversity of plants and animals that share limited resources. Key concepts include
- water-related environments (pond, marshland, swamp, stream, river, and ocean environments);
- dry-land environments (desert, grassland, rainforest, and forest environments); and
- population and community.

Interrelationships in Earth/Space Systems

3.7 The student will investigate and understand the major components of soil, its origin, and importance to plants and animals including humans. Key concepts include
- soil provides the support and nutrients necessary for plant growth;
- topsoil is a natural product of subsoil and bedrock;
- rock, clay, silt, sand, and humus are components of soils; and
- soil is a natural resource and should be conserved.

Earth Patterns, Cycles, and Change

3.8 The student will investigate and understand basic sequences and cycles occurring in nature. Key concepts include
- sequences of natural events (day and night, seasonal changes, phases of the moon, and tides); and
- animal and plant life cycles.

3.9 The student will investigate and understand the water cycle and its relationship to life on Earth. Key concepts include
- the origin of energy that drives the water cycle;
- processes involved in the water cycle (evaporation, condensation, precipitation); and
- water supply and water conservation.

Resources

3.10 The student will investigate and understand that natural events and human influences can affect the survival of species. Key concepts include
- the interdependency of plants and animals;
- human effects on the quality of air, water, and habitat;
- the effects of fire, flood, disease, erosion, earthquake, and volcanic eruption on organisms; and
- conservation, resource renewal, habitat management, and species monitoring.

3.11 The student will investigate and understand different sources of energy. Key concepts include
- the sun's ability to produce light and heat energy;
- natural forms of energy (sunlight, water, wind);
- fossil fuels (coal, oil, natural gas) and wood;
- electricity, nuclear power; and
- renewable and nonrenewable resources.

Grade Four

The fourth-grade standards stress the importance of using information, analyzing data, and validating experimental results. Defining variables in experimentation is emphasized, and making simple predictions from picture, bar, and line graphs is underscored. Questioning and hypothesizing become more detailed at this level. Students are introduced to basic principles of electricity and to the concept of energy as it relates to work and machines. Relationships are investigated in the interactions among the Earth, moon, and sun and among plants and animals and their environments. In examining weather phenomena and conditions, students identify various factors, make predictions based on data, and evaluate the results. The importance of natural resources in Virginia is emphasized.

Scientific Investigation, Reasoning, and Logic

4.1 The student will plan and conduct investigations in which

- distinctions are made among observations, conclusions (inferences), and predictions;
- data are classified to create frequency distributions;
- appropriate metric measures are used to collect, record, and report data;
- appropriate instruments are selected to measure linear distance, volume, mass, and temperature;
- predictions are made based on data from picture graphs, bar graphs, and basic line graphs;
- hypotheses are formulated based on cause and effect relationships;
- variables that must be held constant in an experimental situation are defined; and
- numerical data that are contradictory or unusual in experimental results are recognized.

Force, Motion, and Energy

4.2 The student will investigate and understand that energy is needed to do work and that machines make work easier. Key concepts include

- energy forms (electrical, mechanical, and chemical energy);
- potential and kinetic energy;
- simple and complex machines; and
- efficiency, friction, and inertia.

4.3 The student will investigate and understand the characteristics of electricity. Key concepts include

- the nature of electricity (voltage, ampere, resistance, conductors, and insulators);
- circuits (open/closed, parallel/series);
- magnetism and magnetic fields;
- static electricity ; and
- historical contributions in understanding electricity.

Life Processes

4.4 The student will investigate and understand basic plant anatomy and life processes. Key concepts include

- the structures of typical plants (leaves, stems, roots, and flowers);
- processes and structures involved with reproduction (pollination, stamen, pistil, sepal, embryo, spore, and seed);
- photosynthesis (chlorophyll, carbon dioxide); and
- dormancy.

Living Systems

4.5 The student will investigate and understand how plants and animals in an ecosystem interact with one another and the nonliving environment. Key concepts include

- behavioral and structural adaptations;
- organization of communities;
- flow of energy through food webs;
- habitats and niches;
- life cycles; and
- influence of human activity on ecosystems.

Interrelationships in Earth/Space Systems

4.6 The student will investigate and understand how weather conditions and phenomena occur and can be predicted. Key concepts include

- weather factors (temperature, air pressure, fronts, formation and type of clouds, and storms); and
- meteorological tools (barometer, hygrometer, anemometer, rain gauge, and thermometer).

Earth Patterns, Cycles, and Change

4.7 The student will investigate and understand the relationships among the Earth, moon, and sun. Key concepts include

- the motions of the Earth, moon, and sun (revolution and rotation);
- the causes for the Earth's seasons and phases of the moon;
- the relative size, position, and makeup of the Earth, moon, and sun;
- unique properties of the Earth as a planet and as part of the solar system; and
- historical contributions in understanding the Earth-moon-sun system.

Resources

4.8 The student will investigate and understand important Virginia natural resources. Key concepts include

- watershed and water resources;
- animals and plants, both domesticated and wild;
- minerals, rocks, ores, and energy sources; and
- forests, soil, and land.

Grade Five

The fifth-grade standards emphasize the importance of selecting appropriate instruments for measuring and recording observations. The organization, analysis, and application of data continue to be an important focus of classroom inquiry. Science skills from preceding grades, including questioning, using and validating evidence, and systematic experimentation, are reinforced at this level. Students are introduced to more detailed concepts of sound and light and the tools used for studying them. Key concepts of matter include atoms, molecules, elements, and compounds, and the properties of matter are defined in greater detail. The cellular makeup of organisms and the distinguishing characteristics of groups of organisms are stressed. Students will learn about the characteristics of the oceans and the Earth's changing surface.

Scientific Investigation, Reasoning, and Logic

5.1 The student will plan and conduct investigations in which
- appropriate instruments are selected and used for making quantitative observations of length, mass, volume, and elapsed time;
- rocks, minerals, and organisms are identified using a classification key;
- data are collected, recorded, and reported using the appropriate graphical representation (graphs, charts, diagrams);
- accurate measurements are made using basic tools (thermometer, meter stick, balance, graduated cylinder);
- predictions are made using patterns, and simple graphical data are extrapolated; and
- estimations of length, mass, and volume are made.

Force, Motion, and Energy

5.2 The student will investigate and understand how sound is transmitted and is used as a means of communication. Key concepts include
- frequency, waves, wavelength, resonance, vibration;
- the ability of different media (solids, liquids, gases) to transmit sound; and
- communication tools (voice, Morse code, sonar, animal sounds, musical instruments).

5.3 The student will investigate and understand basic characteristics of white light. Key concepts include
- the visible spectrum, light waves, reflection, refraction, diffraction, opaque, transparent, translucent;
- optical tools (eyeglasses, lenses, flashlight, camera, kaleidoscope, binoculars, microscope, light boxes, telescope, prism, spectroscope, mirrors); and
- historical contributions in understanding light.

Matter

5.4 The student will investigate and understand that matter is anything that has mass; takes up space; and occurs as a solid, liquid, or gas. Key concepts include
- atoms, molecules, elements, and compounds;
- mixtures and solutions; and
- effect of temperature on the states of matter.

Living Systems

5.5 The student will investigate and understand that organisms are made of cells and have distinguishing characteristics. Key concepts include
- parts of a cell;
- five kingdoms of living things;
- vascular and nonvascular plants; and
- vertebrates and invertebrates.

Interrelationships in Earth/Space Systems

5.6 The student will investigate and understand characteristics of the ocean environment. Key concepts include
- geological characteristics (continental shelf, slope, rise);
- physical characteristics (depth, salinity, major currents);
- biological characteristics (ecosystems); and
- public policy decisions related to the ocean environment (assessment of marine organism populations, pollution prevention).

Earth Patterns, Cycles, and Change

5.7 The student will investigate and understand how the Earth's surface is constantly changing. Key concepts include
- the rock cycle including the identification of rock types;
- Earth history and fossil evidence;

- the basic structure of the Earth's interior;
- plate tectonics (earthquakes and volcanoes);
- weathering and erosion; and
- human impact.

Computer/Technology Standards by the End of Grade Five

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 5** include the following:

C/T5.1 The student will demonstrate a basic understanding of computer theory including bits, bytes, and binary logic.

C/T5.2 The student will develop basic technology skills.

- Develop a basic technology vocabulary that includes cursor, software, memory, disk drive, hard drive, and CD-ROM.
- Select and use technology appropriate to tasks.
- Develop basic keyboarding skills.
- Operate peripheral devices.
- Apply technologies to strategies for problem solving and critical thinking.

C/T5.3 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information using databases, CD-ROMs, videodiscs, and telecommunications.
- Use electronic encyclopedias, almanacs, indexes, and catalogs.
- Use local and wide-area networks and modem-delivered services to access information from electronic databases.
- Describe advantages and disadvantages of various computer processing, storage, retrieval, and transmission techniques.

C/T5.4 The student will communicate through application software.

- Create a 1-2 page document using word processing skills, writing process steps, and publishing programs.
- Use simple computer graphics and integrate graphics into word-processed documents.
- Create simple databases and spreadsheets to manage information and create reports.
- Use local and worldwide network communication systems.

Grade Six

The sixth-grade standards continue to emphasize data analysis and experimentation. Methods are studied for testing the validity of predictions and conclusions. Scientific methodology, focusing on precision in stating hypotheses and defining dependent and independent variables, is strongly reinforced. The concept of change is explored through the study of transformations of energy and matter, both in living things and in the physical sciences. A more detailed understanding of the solar system becomes a focus of instruction. Natural resource management and its relation to public policy and cost/benefit tradeoffs are introduced.

Scientific Investigation, Reasoning, and Logic

6.1 The student will plan and conduct investigations in which

- observations are made involving fine discrimination between similar objects and organisms;
- a classification system is developed based on multiple attributes;
- differences in descriptions and working definitions are made;
- precise and approximate measures are recorded;
- scale models are used to estimate distance, volume, and quantity;
- hypotheses are stated in ways that identify the independent (manipulated) and dependent (responding) variables;
- a method is devised to test the validity of predictions and inferences;
- one variable is manipulated over time with many repeated trials;
- data are collected, recorded, analyzed, and reported using appropriate metric measurement;
- data are organized and communicated through graphical representation (graphs, charts, and diagrams); and
- models are designed to explain a sequence.

6.2 The student will demonstrate scientific reasoning and logic. Key concepts include

- ideas are investigated by asking for and actively seeking information;
- multiple tests of ideas are performed before accepting or rejecting them;
- alternative scientific explanations are analyzed; and
- conclusions are based on scientific evidence obtained from a variety of sources.

Force, Motion, and Energy

6.3 The student will investigate and understand sources of energy and their transformations. Key concepts include

- potential and kinetic energy;
- energy sources (fossil fuels, wood, wind, water, solar, and nuclear power); and
- energy transformations (mechanical to electrical, electrical to heat/light, chemical to light, and chemical to electrical/light).

6.4 The student will investigate and understand basic characteristics of electricity. Key concepts include

- electrical energy can be produced from a variety of energy sources and can be transformed into almost any other form of energy;
- electricity is related to magnetism;
- currents are either alternating or direct;
- circuits can be parallel or series;
- electrical energy can be described in volts and amps; and
- electrical energy consumption is measured using common units (kilowatts/kilowatt hours).

Matter

6.5 The student will investigate and understand that all matter is made up of atoms. Key concepts include

- atoms are made up of electrons, protons, and neutrons;
- atoms of any element are alike but are different from atoms of other elements; and
- historical development and significance of discoveries related to the atom.

6.6 The student will investigate and understand how to classify materials as elements, compounds, or mixtures. Key concepts include

- mixtures can be separated by physical processes;
- compounds can only be separated by chemical processes; and
- elements cannot be separated by physical or chemical means.

6.7 The student will investigate and understand that matter has physical and chemical properties and can undergo change. Key concepts include

- physical changes; and
- changes in chemical composition, including oxidation reactions (rusting and burning), photosynthesis, and acid-base neutralization reactions.

Life Processes

6.8 The student will investigate and understand that organisms perform life processes that are essential for the survival and perpetuation of the species. Key concepts include

- energy transformation (from food or photosynthesis); and
- respiration, movement, waste removal, growth, irritability (response), and reproduction.

Living Systems

6.9 The student will investigate and understand that organisms depend on other organisms and the nonliving components of the environment. Key concepts include

- producers, consumers, and decomposers;

- food webs and food pyramids; and
- cycles (water, carbon dioxide/oxygen, nitrogen).

Interrelationships in Earth/Space Systems

6.10 The student will investigate and understand the organization of the solar system and the relationships among the various bodies that comprise it. Key concepts include

- the, sun, moon, Earth, other planets and their moons, meteors, asteroids, and comets;
- relative size of and distance between planets;
- the role of gravity;
- revolution and rotation;
- the mechanics of day and night and phases of the moon;
- the relationship of the Earth's tilt and seasons;
- the cause of tides; and
- the history and technology of space exploration.

Resources

6.11 The student will investigate and understand public policy decisions relating to the environment. Key concepts include

- management of renewable resources (water, air, plant life, animal life);
- management of nonrenewable resources (coal, oil, natural gas, nuclear power); and
- cost/benefit tradeoffs in conservation policies.

Life Science

The Life Science standards emphasize a more complex understanding of change, cycles, patterns, and relationships in the living world. Students build on basic principles related to these concepts by exploring the cellular organization and the classification of organisms; the dynamic relationships among organisms, populations, communities and ecosystems; and change as a result of the transmission of genetic information from generation to generation. Inquiry skills at this level include organization and mathematical analysis of data, manipulating variables in experimentation, and identifying sources of experimental error.

LS.1 The student will plan and conduct investigations in which

- data are organized into tables showing repeated trials and means;
- variables are defined;
- SI (metric) units are used;
- criteria are established for evaluating a prediction;
- models are constructed to illustrate and explain phenomena;
- sources of experimental error are identified;
- dependent variables, independent variables, and constants are identified;
- variables are controlled to test hypotheses and trials are repeated;
- continuous line graphs are constructed, interpreted, and used to make predictions; and
- interpretations from the same set of data are evaluated and defended.

LS.2 The student will investigate and understand that all living things are composed of cells. Key concepts include

- cell structure and organelles (cell membrane, cell wall, cytoplasm, vacuole, mitochondrion, endoplasmic reticulum, nucleus and chloroplast);
- similarities and differences between plant and animal cells;
- development of cell theory; and
- cell division (mitosis and meiosis).

LS.3 The student will investigate and understand that living things show patterns of cellular organization. Key concepts include

- cells, tissues, organs, and systems; and
- functions and processes of cells, tissues, organs, and systems (respiration, removal of wastes, growth, reproduction, digestion, and cellular transport).

LS.4 The student will investigate and understand that the basic needs of organisms must be met in order to carry out life processes. Key concepts include

- plant needs (light and energy sources, water, gases, nutrients);
- animal needs (food, water, gases, shelter, space); and
- factors that influence life processes.

LS.5 The student will investigate and understand classification of organisms. Key concepts include

- differences in number, color, size, shape, and texture of external and internal structures; and
- variation in method of locomotion, obtaining nourishment, and reproduction.

LS.6 The student will investigate and understand the basic physical and chemical processes of photosynthesis and its importance to plant and animal life. Key concepts include

- energy transfer between sunlight and chlorophyll;
- transformation of water and carbon dioxide into sugar, water, and oxygen; and
- photosynthesis as the foundation of food webs.

LS.7 The student will investigate and understand that organisms within an ecosystem are dependent on one another and on nonliving components of the environment. Key concepts include

- interactions resulting in a flow of energy and matter throughout the system;
- complex relationships in terrestrial, freshwater, and marine ecosystems; and
- energy flow in food chains, food webs, and food pyramids.

LS.8 The student will investigate and understand that interactions exist among members of a population. Key concepts include

- competition, cooperation, social hierarchy, territorial imperative; and
- influence of behavior on population interactions.

LS.9 The student will investigate and understand interactions among populations in a biological community. Key concepts include

- the relationship among producers, consumers, and decomposers in food chains and food webs;
- the relationship of predators and prey;
- competition and cooperation;
- symbiotic relationships and niches; and
- the role of parasites and their hosts.

LS.10 The student will investigate and understand how organisms adapt to biotic and abiotic factors in a biome. Key concepts include

- differences between ecosystems and biomes;
- characteristics of land, marine, and freshwater biomes; and
- adaptations that enable organisms to survive within a specific biome.

LS.11 The student will investigate and understand that ecosystems, communities, populations, and organisms are dynamic and change over time (daily, seasonal, and long term). Key concepts include

- phototropism, hibernation, and dormancy;
- factors that increase or decrease population size; and
- eutrophication, climate change, and catastrophic disturbances.

LS.12 The student will investigate and understand the relationships between ecosystem dynamics and human activity. Key concepts include

- food production and harvest;
- change in habitat size, quality, and structure;
- change in species competition;
- population disturbances and factors that threaten and enhance species survival; and
- environmental issues (water supply, air quality, energy production, and waste management).

LS.13 The student will investigate and understand that organisms reproduce and transmit genetic information to new generations. Key concepts include

- the role of DNA;
- characteristics that can and cannot be inherited;
- genetic engineering and its applications; and
- historical contributions and significance of discoveries related to genetics.

LS.14 The student will investigate and understand that organisms change over time. Key concepts include

- the relationships of mutation, adaptation, natural selection, and extinction;
- evidence of evolution of different species in the fossil record; and
- how environmental influences, as well as genetic variation, can lead to diversity of organisms.

Physical Science

The Physical Science standards continue to build on skills of systematic investigation with a clear focus on variables and repeated trials. Validating conclusions using evidence and data becomes increasingly important at this level. Students will plan and conduct research involving both classroom experimentation and literature reviews from written and electronic resources. Research methods and skills highlight practical problems and questions. Students will share their work using written reports and other presentations.

The Physical Science standards stress a more in-depth understanding of the nature and structure of matter and the characteristics of energy. The standards place considerable emphasis on the technological application of physical science principles. Major areas covered by the standards include the periodic table; physical and chemical changes; nuclear reactions; temperature and heat; sound; light; electricity and magnetism; and work, force, and motion.

PS.1 The student will plan and conduct investigations in which

- length, mass, volume, density, temperature, weight, and force are accurately measured and reported using the International System of Units (SI - metric);
- triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, and spring scales are used to gather data;
- data from experiments are recorded and interpreted from bar, line, and circle graphs;
- research skills are utilized using a variety of resources;
- independent and dependent variables, constants, controls, and repeated trials are identified;
- valid conclusions are made after analyzing data;
- research methods are used to investigate practical problems and questions; and
- experimental results are presented in appropriate written form.

PS.2 The student will investigate and understand the basic nature of matter. Key concepts include

- the particle theory of matter;
- elements, compounds, mixtures, acids, bases, salts, organic, inorganic, solids, liquids, and gases;
- characteristics of types of matter based on physical and chemical properties;
- physical properties (shape, density, solubility, odor, melting point, boiling point, color); and
- chemical properties (acidity, basicity, combustibility, reactivity).

PS.3 The student will investigate and understand various models of atomic structure including Bohr and Cloud (quantum) models.

PS.4 The student will investigate and understand how to use the periodic table of elements to obtain information. Key concepts include

- symbols, atomic numbers, atomic mass, chemical families, periods, valence numbers, metals, metalloids, and nonmetals; and
- binary compounds (chemical activity, physical properties, formulas, and nature of bonding).

PS.5 The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts include

- physical changes (effect of temperature on state, particle size on solubility, and temperature on solubility);
- nuclear reactions (products of fusion and fission and their effects on human beings and the environment); and
- chemical changes (types of reactions, reactants and products, and balanced equations).

PS.6 The student will investigate and understand states and forms of energy and how energy is transferred and transformed. Key concepts include

- potential and kinetic energy;
- mechanical, chemical, and electrical energy; and
- heat, light, and sound.

PS.7 The student will investigate and understand temperature scales, heat, and heat transfer. Key concepts include

- absolute zero, phase change, freezing point, melting point, boiling point, conduction, convection, radiation, vaporization, and condensation; and
- applications of heat transfer (heat engines, thermostats, and refrigeration).

PS.8 The student will investigate and understand characteristics of sound and technological applications of sound waves. Key concepts include

- wave length, frequency, amplitude, interference; and
- technological applications of sound.

PS.9 The student will investigate and understand the nature and technological applications of light. Key concepts include

- reflection, refraction, particle theory, wave theory; and
- electromagnetic spectrum.

PS.10 The student will investigate and understand scientific principles and technological applications of work, force, and motion. Key concepts include

- work, force, mechanical advantage, efficiency, power, horsepower, gravitational force, speed/velocity, mass/weight, Newton's three laws of motion, acceleration; and
- applications (simple machines, compound machines, powered vehicles, rockets, restraining devices, projectiles).

PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include

- static, current, circuits; and
- magnetic fields and electromagnets.

Computer/Technology Standards by the End of Grade Eight

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 8** include the following:

C/T8.1 The student will communicate through application software.

- Compose and edit a multipage document at the keyboard, using word processing skills and the writing process steps.
- Communicate with spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data.
- Communicate with databases by defining fields and entering data, sorting, and producing reports in various forms.
- Use advanced publishing software, graphics programs, and scanners to produce page layouts.
- Integrate databases, graphics, and spreadsheets into word-processed documents.

C/T8.2 The student will communicate through networks and telecommunication.

- Use local and worldwide network communication systems.
- Develop hypermedia "home page" documents that can be accessed by worldwide networks.

C/T8.3 The student will have a basic understanding of computer processing, storing, retrieval, and transmission technologies and a practical appreciation of the relevant advantages and disadvantages of various processing, storage, retrieval, and transmission technologies.

C/T8.4 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information.
- Use electronic encyclopedias, almanacs, indexes, and catalogs to retrieve and select relevant information.
- Use laser discs with a computer in an interactive mode.
- Use local and wide-area networks and modem-delivered services to access and retrieve information from electronic databases.
- Use databases to perform research.

Earth Science

The Earth Science standards connect the study of the Earth's composition, structure, processes, and history; its atmosphere, fresh water, and oceans; and its environment in space. The standards emphasize historical contributions in the development of scientific thought about the Earth and space. The standards stress the interpretation of maps, charts, tables, and profiles; the use of technology to collect, analyze, and report data; and science skills in systematic investigation. Problem solving and decision making are an integral part of the standards, especially as they relate to the costs and benefits of utilizing the Earth's resources. Major topics of study include plate tectonics, the rock cycle, Earth history, the oceans, the atmosphere, weather and climate, and the solar system and universe.

ES.1 The student will plan and conduct investigations in which

- volume, area, mass, elapsed time, direction, temperature, pressure, distance, density, and changes in elevation/depth are calculated utilizing the most appropriate tools;
- technologies, including computers, are used to collect, analyze, and report data and to demonstrate concepts and simulate experimental conditions;
- scales, diagrams, maps, charts, graphs, tables, and profiles are constructed and interpreted;
- variables are manipulated with repeated trials; and
- a scientific viewpoint is constructed and defended.

ES.2 The student will demonstrate scientific reasoning and logic by

- analyzing how science explains and predicts the interactions and dynamics of complex Earth systems;
- recognizing that evidence is required to evaluate hypotheses and explanations;
- comparing different scientific explanations for the same observations about the Earth;
- explaining that observation and logic are essential for reaching a conclusion;
- evaluating evidence for scientific theories related to plate tectonics, the structure of the Earth, and its ancient age and origin; and
- making informed judgments related to resource use and its effects on Earth systems.

ES.3 The student will investigate and understand how to read and interpret maps, globes, models, charts, and imagery. Key concepts include

- maps (bathymetric, geologic, topographic, and weather) and star charts;
- imagery (aerial photography and satellite images);
- direction and distance measurements on any map or globe; and
- location by latitude and longitude and topographic profiles.

ES.4 The student will investigate and understand the characteristics of the Earth including

- plate tectonics;
- water in all three states;
- position of the Earth in the solar system; and
- effects of density differences and energy transfer on the activities of the atmosphere, oceans, and Earth's interior.

ES.5 The student will investigate and understand how to identify major rock-forming and ore minerals based on physical and chemical properties. Key concepts include

- properties including hardness, color and streak, luster, cleavage, fracture, and unique properties; and
- uses of minerals.

ES.6 The student will investigate and understand how to identify common rock types based on mineral composition and textures and the rock cycle as it relates to the transformation of rock types. Key concepts include

- igneous (intrusive and extrusive);
- sedimentary (clastic and chemical); and
- metamorphic (foliated and unfoliated) rocks.

ES.7 The student will investigate and understand the differences between renewable and nonrenewable resources. Key concepts include

- fossil fuels, minerals, rocks, water, and vegetation;
- advantages and disadvantages of various energy sources;
- resources found in Virginia;
- use of resources and their effects on standards of living; and
- environmental costs and benefits.

ES.8 The student will investigate and understand geologic processes including plate tectonics. Key concepts include

- how geologic processes are evidenced in the physiographic provinces of Virginia including the Coastal Plain, Piedmont, Blue Ridge, Valley and Ridge, and Appalachian Plateau;
- processes (faulting, folding, volcanism, metamorphism, weathering, erosion, deposition, and sedimentation) and their resulting features; and
- tectonic processes (subduction, rifting and sea floor spreading, and continental collision).

ES.9 The student will investigate and understand how freshwater resources are influenced by geologic processes and the activities of humans. Key concepts include

- processes of soil development;
- development of karst topography;
- identification of groundwater zones including water table, zone of saturation, and zone of aeration;
- identification of other sources of fresh water including aquifers with reference to the hydrologic cycle; and
- dependence on freshwater resources and the affects of human usage on water quality.

ES.10 The student will investigate and understand that many aspects of the history and evolution of the Earth and life can be inferred by studying rocks and fossils. Key concepts include

- traces or remains of ancient, often extinct, life are preserved by various means in many sedimentary rocks;
- superposition, cross-cutting relationships, and radioactive decay are methods of dating bodies of rock;
- absolute and relative dating have different applications but can be used together to determine the age of rocks and structures; and
- rocks and fossils from many different geologic periods and epochs are found in Virginia.

ES.11 The student will investigate and understand that oceans are complex, interactive physical, chemical, and biological systems and are subject to long- and short-term variations. Key concepts include

- physical and chemical changes (tides, waves, currents, sea level and ice cap variations, upwelling, and salinity concentrations);
- importance of environmental, geologic, and economic implications;
- systems interactions (energy transfer, weather, and climate);
- features of the sea floor (continental margins, trenches, mid-ocean ridges, and abyssal plains) reflect tectonic processes; and
- public policy issues concerning the oceans.

ES.12 The student will investigate and understand the origin and evolution of the atmosphere and the interrelationship of geologic processes, biologic processes, and human activities on its composition and dynamics. Key concepts include

- scientific evidence for atmospheric changes over geologic time;
- current theories related to the effects of early life on the chemical makeup of the atmosphere;
- comparison of the Earth's atmosphere to that of other planets;
- atmospheric regulation mechanisms; and
- potential atmospheric compositional changes due to human, biologic, and geologic activity.

ES.13 The student will investigate and understand that energy transfer between the sun, Earth, and the Earth's atmosphere drives weather and climate on Earth. Key concepts include

- observation and collection of weather data;
- prediction of weather patterns; and
- weather phenomena and the factors that affect climate.

ES.14 The student will investigate and understand the planets and other members of the solar system; the history and contributions of the space program; and concepts related to the origin and evolution of the solar system, galaxy, and universe. Key concepts include

- characteristics of the sun, planets, their moons, comets, meteors, and asteroids; and
- cosmology and the origin of stars and stellar systems (the Big Bang, the solar nebular theory, stellar evolution, star systems, nebulae, constellations, and galaxies).

Biology

The standards for Biology are designed to provide students with a detailed understanding of living systems. Emphasis continues to be placed on the skills necessary to examine alternative scientific explanations, actively conduct controlled experiments, analyze and communicate information, and acquire and use scientific literature. The history of biological thought and the evidence that supports it are explored and provide the foundation for investigating biochemical life processes, cellular organization, mechanisms of inheritance, dynamic relationships among organisms, and the change in organisms through time. The importance of scientific research that validates or challenges ideas is emphasized at this level.

BIO.1 The student will plan and conduct investigations in which
- observations of living things are recorded in the lab and in the field;
- hypotheses are formulated based on observations;
- variables are defined and investigations are designed to test hypotheses;
- graphing and arithmetic calculations are used as tools in data analysis;
- conclusions are formed based on recorded quantitative and qualitative data;
- impacts of sources of error inherent in experimental design are identified and discussed;
- validity of data is determined;
- alternative explanations and models are recognized and analyzed;
- appropriate technology is used for gathering and analyzing data and communicating results; and
- research is used based on popular and scientific literature.

BIO.2 The student will investigate and understand the history of biological concepts. Key concepts include
- evidence supporting the cell theory;
- scientific explanations of the development of organisms through time;
- causative agents of disease;
- the evolution of the DNA model; and
- the collaborative efforts of scientists, past and present.

BIO.3 The student will investigate and understand biochemical principles essential for life. Key concepts include
- water chemistry and its impact on life processes;
- the structure and function of macromolecules;
- the nature of enzymes; and
- the significance of and relationship between photosynthesis and respiration.

BIO.4 The student will investigate and understand relationships between cell structure and function. Key concepts include
- characterizing prokaryotic organisms;
- exploring the diversity and variation of eukaryotes;
- building analogies between the activities of a single cell and a whole organism; and
- modeling the cell membrane, cell communication, and cell recognition.

BIO.5 The student will investigate and understand life functions of monerans, protists, fungi, plants, and animals, including humans. Key concepts include
- how their structures are alike and different;
- comparison of their metabolic activities;
- analyses of their responses to the environment;
- maintenance of homeostasis;
- human health issues, human anatomy, body systems, and life functions;
- how viruses compare with organisms; and
- observation of local organisms when applicable.

BIO.6 The student will investigate and understand common mechanisms of inheritance and protein synthesis. Key concepts include
- cell division;
- sex cell formation;
- cell specialization;
- prediction of inheritance of traits based on the laws of heredity;
- effects of genetic recombination and mutation;
- events involved in the construction of proteins; and
- exploration of the impact of DNA technologies.

BIO.7 The student will investigate and understand bases for modern classification systems. Key concepts include
- structural similarities in organisms;
- fossil record interpretation;

- comparison of developmental stages in different organisms;
- examination of protein similarities and differences among organisms;
- comparison of DNA sequences in organisms;
- systems of classification that are adaptable to new scientific discoveries; and
- examination of local flora and fauna where applicable.

BIO.8 The student will investigate and understand how populations change through time. Key concepts include

- examining evidence found in fossil records;
- investigating how variation of traits, reproductive strategies, and environmental pressures impact on the survival of populations;
- recognizing how adaptations lead to natural selection; and
- exploring how new species emerge.

BIO.9 The student will investigate and understand dynamic equilibria within populations, communities, and ecosystems. Key concepts include

- interactions within and among populations including carrying capacities, limiting factors, and growth curves;
- nutrient cycling with energy flow through ecosystems;
- succession patterns in ecosystems;
- the effects of natural events and human influences on ecosystems; and
- analysis of local ecosystems.

Chemistry

The Chemistry standards are designed to provide students with a detailed understanding of the interaction of matter and energy. This interaction is investigated through the use of laboratory techniques, manipulation of chemical quantities, and problem-solving applications. Scientific methodology will be employed in experimental and analytical investigations, and concepts will be illustrated with practical applications.

Technology including graphing calculators and computers will be employed where feasible. Students will understand and use safety precautions with chemicals and equipment. The standards emphasize qualitative and quantitative study of substances and the changes that occur in them. In meeting the chemistry standards, students will be encouraged to share their ideas, use the language of chemistry, discuss problem-solving techniques, and communicate effectively.

CH.1 The student will investigate and understand that experiments in which variables are measured, analyzed, and evaluated, produce observations and verifiable data. Key concepts include

- designated laboratory techniques;
- safe use of chemicals and equipment;
- proper response to emergency situations;
- multiple variables are manipulated with repeated trials;
- accurate recording, organizing, and analysis of data through repeated trials;
- mathematical and procedural error analysis; and
- mathematical manipulations (SI units, scientific notation, linear equations, graphing, ratio and proportion, significant digits, dimensional analysis, use of scientific calculator).

CH.2 The student will investigate and understand that the placement of elements on the periodic table is a function of their atomic structure. The periodic table is a tool used for the investigations of

- mass/atomic number;
- isotopes/half-lives/nuclear particles;
- particle/mass charge;
- families/groups;
- series/periods;
- trends/patterns: atomic/nuclear radii, electronegativity, shielding effect;

- electron configurations/oxidation numbers;
- chemical/physical properties; and
- historical/quantum models.

CH.3 The student will investigate and understand how conservation of energy and matter is expressed in chemical formulas and balanced equations. Key concepts include

- nomenclature;
- balancing chemical equations;
- writing chemical formulas—molecular, structural, empirical, and Lewis diagrams;
- bonding types—ionic, covalent;
- reaction types—synthesis, decomposition, single and double replacement, oxidation-reduction, neutralization, nuclear, exothermic and endothermic, spontaneous/non-spontaneous, dissociation ionization;
- physical and chemical equilibrium; and
- reaction rates and kinetics: activation energy, catalysis, degree of randomness.

CH.4 The student will investigate and understand that quantities in a chemical reaction are based on molar relationships. Key concepts include

- avogadro's principle, molar volume;
- stoichiometric relationships;
- partial pressure;
- gas laws;
- solution concentrations;
- chemical equilibrium; and
- acid/base theory: strong/weak electrolytes, dissociation/ionization (pH, pOH), and titration.

CH.5 The student will investigate and understand that the phases of matter are explained by kinetic theory and forces of attraction between particles. Key concepts include

- pressure, temperature, and volume;
- vapor pressure;
- partial pressures;
- phase changes;
- molar heats of fusion and vaporization;
- specific heat capacity;
- solutions; and
- colligative properties.

CH.6 The student will investigate and understand how basic chemical principles relate to other areas of chemistry. Key concepts include

- organic and biochemistry;
- nuclear chemistry; and
- environmental chemistry.

Physics

The Physics standards emphasize a more complex understanding of experimentation, the analysis of data, and the use of reasoning and logic to evaluate evidence. The use of mathematics, including algebra, inferential statistics, and trigonometry, is important, but conceptual understanding of physical systems remains a primary concern. Students build on basic physical science principles by exploring in depth the nature and characteristics of energy and its dynamic interaction with matter. Key areas covered by the standards include force and motion, kinetic molecular theory, energy transformations, wave phenomena and the electromagnetic spectrum, light, electricity, fields, and non-Newtonian physics. The standards stress the practical application of physics in other areas of science and technology and how physics affects our world.

PH.1 The student will investigate and understand how to plan and conduct investigations in which

- the components of a system are defined;
- instruments are selected and used to extend observations and measurements of mass, volume, temperature, heat exchange, energy transformations, motion, fields, and electric charge;
- information is recorded and presented in an organized format;
- metric units are used in all measurements and calculations;
- the limitations of the experimental apparatus and design are recognized;
- the limitations of measured quantities through the appropriate use of significant figures or error ranges are recognized; and
- data gathered from non-SI instruments are incorporated through appropriate conversions.

PH.2 The student will investigate and understand how to analyze and interpret data. Key concepts include
- a description of a physical problem is translated into a mathematical statement in order to find a solution;
- relationships between physical quantities are determined using the shape of a curve passing through experimentally obtained data;
- the slope of a linear relationship is calculated and includes appropriate units;
- interpolated, extrapolated, and analyzed trends are used to make predictions;
- inferential statistical tests are applied in evaluating experimental data; and
- analysis of systems employs vector quantities utilizing trigonometric and graphical methods.

PH.3 The student will investigate and understand how to demonstrate scientific reasoning and logic. Key concepts include
- analysis of primary sources to develop and refine research hypotheses;
- analysis of how science explains and predicts relationships; and
- evaluation of evidence for scientific theories and how new discoveries may either modify existing theories or result in establishing a new paradigm.

PH.4 The student will investigate and understand how applications of physics affect the world. Key concepts include
- principles with examples from the real world; and
- exploration of the roles and contributions of science and technology.

PH.5 The student will investigate and understand the interrelationships among mass, distance, force, and time through mathematical and experimental processes. Key concepts include
- linear motion;
- uniform circular motion;
- curvilinear motion;
- Newton's laws of motion;
- gravitation;
- celestial mechanics; and
- work, power, and energy.

PH.6 The student will investigate and understand that quantities including mass, energy, momentum, and charge are conserved. Key concepts include
- kinetic and potential energy;
- elastic and inelastic collisions; and
- electric power and circuit design.

PH.7 The student will investigate and understand that the kinetic molecular theory can be applied to solve quantitative problems involving pressure, volume, and temperature.

PH.8 The student will investigate and understand that energy can be transferred and transformed to provide usable work. Key concepts include
- transformation of energy among forms, including mechanical, thermal, electrical, gravitational, chemical, and nuclear; and
- efficiency of systems.

PH.9 The student will investigate and understand how to use models of transverse and longitudinal waves to interpret wave phenomena. Key concepts include
- wave characteristics (period, wavelength, frequency, amplitude and phase);
- fundamental wave processes (reflection, refraction, diffraction, interference, standing waves, polarization, Doppler effect); and
- light and sound in terms of wave models.

PH.10 The student will investigate and understand that different frequencies and wavelengths in the electromagnetic spectrum are phenomena ranging from radio waves through visible light to gamma radiation. Key concepts include
- the properties and behaviors of radio, microwaves, infra-red, visible light, ultra-violet, X-rays, and gamma rays; and
- current applications based on the wave properties of each band.

PH.11 The student will investigate and understand how light behaves in the fundamental processes of reflection, refraction, and image formation in describing optical systems. Key concepts include
- application of the laws of reflection and refraction;
- construction and interpretation of ray diagrams;
- development and use of mirror and lens equations; and
- predictions of type, size, and position of real and virtual images.

PH.12 The student will investigate and understand how to use the field concept to describe the effects of electric, magnetic, and gravitational forces. Key concepts include
- inverse square laws;
- Newton's law of universal gravitation;
- Coulomb's law; and

- operating principles of motors, generators, and cathode ray tubes.

PH.13 The student will investigate and understand how to diagram and construct basic electrical circuits and explain the function of various circuit components. Key concepts include

- Ohm's law; and
- series, parallel, and combined circuits.

PH.14 The student will investigate and understand that extremely large and extremely small quantities are not necessarily described by the same laws as those studied in Newtonian physics. Key concepts include

- wave/particle duality;
- wave properties of matter;
- matter/energy equivalence;
- quantum mechanics and uncertainty;
- relativity;
- nuclear physics;
- solid state physics;
- superconductivity; and
- radioactivity.

English Standards of Learning

for Virginia Public Schools

English
Standards of Learning

Goals

The goals of English education are to teach students to read and to prepare students to participate in society as literate citizens, equipped with the ability to communicate effectively in their communities, in the work place, and in postsecondary education. As students progress through the school years, they will become active and involved listeners and will develop a full command of the English language, evidenced by their use of standard English and their rich speaking and writing vocabularies.

Students will become familiar with exemplary authors and literary works through a sustained and structured study of literature. Students will read selections which encompass all literary types and exemplify universal themes, that transcend time and place, and encourage students to acquire a lifelong love of reading. A significant percentage of readings at each grade level will be literary classics, that is, poems, stories, essays, plays, and books that have withstood the test of time. Proficient use of the English language will enable students to explore and articulate the complex issues and ideas encountered in public and personal life. Students will acquire the ability to make full and effective use of the written language in their future educational, occupational, and personal endeavors.

Organization

Standards for each grade level are organized in four related strands: oral language, reading/literature, writing, and research. Each grade level is preceded by an overview that describes the major concepts and skills that each student will be expected to understand and demonstrate. The standards reflect a balanced instructional program and document a progression of expected achievement in each of the four strands. English standards are organized by grade level because schools are typically organized by grade levels. This organization of standards also reflects the gradual progression in the development of skills.

Oral language includes speaking and listening. In the early grades, students will learn to participate in classroom discussion. Over the course of several grade levels, students will learn to prepare and to deliver presentations and to critique them in order to improve delivery. Students' homes and cultural languages are the starting point for all language learning; however, competency in the use of standard English is the goal for all students. Therefore, daily speaking opportunities, both formal and informal, should be a part of every English program.

Reading begins with an awareness of the concepts of print and the sounds and structure of language. Students acquire a strong foundation in phonetic principles in the primary grades. Students will use independent reading strategies to read fluently and with comprehension. Students study the structure of words and language throughout all grades. Frequent interaction with a broad array of quality literature will engage the reading skills of students and invite them to develop an appreciation for the power and beauty of the written word.

Writing begins with letter formation. Students become increasingly aware of the structure of language and improve written communication through frequent opportunities to apply narrative, persuasive, and expository skills. Daily reading, writing, and oral language experiences are essential for all students. A combination of teacher-guided reading experiences and student reading choices is necessary in helping students develop a lifelong reading habit and an appreciation for literature. Developing this appreciation is a process that should be emphasized at every grade level.

Research standards also are developed across grade levels. Through these standards, students will learn to acquire information from a variety of sources. Information may be used in planning and delivering presentations and reports.

Although the strands are developed separately, they are integrated in the classroom. Students use speaking and listening as they read and write. Students use reading, writing, speaking, and listening as they work on research projects. The English strands also are critical if students are to be successful in learning other subjects. Students research topics in history and social science, write summaries of science experiments, and explain mathematical problem-solving strategies.

Student learning is enhanced through the use of computer technology. Data access, retrieval, and processing support instruction in reading, writing, and research. In composition, word processing programs allow students to check spelling, grammar, and style to revise drafts. Informational electronic databases are an integral part of student research and help students to produce effective written and oral presentations. However, use of computer-aided spelling and grammar are not substitutes for learning the rules of English. Please note the Computer/Technology standards following grade five and grade eight standards, respectively. The teaching of these skills should be the shared responsibility of teachers of all disciplines.

Proficiency in reading, writing, listening, speaking, and research skills allows students to learn and use knowledge to make meaningful connections between their lives and academic disciplines. There should be a concerted effort to relate required reading selections in English to studies in other core subjects, including math, science, and, especially, history and social science. Standards that incorporate rigor in English will help students develop the expected performance competencies.

Kindergarten

The kindergarten student will be immersed in a literature-rich environment to develop oral language skills and an appreciation for literature. Number words and descriptive vocabulary will be used in math and science activities which require counting, sorting, and observing the physical properties of people, places, and things. The use of time lines and development of concepts of past and present in history and social science will provide the kindergarten student with opportunities to use words that describe people, places, events, and time relationships. The student will recognize and print letters of the alphabet, use basic phonetic principles, identify story elements, and communicate ideas through pictures and writing.

Oral Language

K.1 The student will demonstrate growth in the use of oral language.
- Listen to a variety of literary forms, including stories and poems.
- Participate in choral speaking and recite short poems, rhymes, songs, and stories with repeated patterns.
- Participate in creative dramatics.
- Begin to discriminate between spoken words and sentences.
- Substitute words in a rhyming pattern.

K.2 The student will use listening and speaking vocabularies.
- Use number words.
- Use words to describe/name people, places, and things.
- Use words to describe location, size, color, and shape.
- Use words to describe actions.
- Ask about words not understood.
- Follow one-step and two-step directions.

K.3 The student will build oral communication skills.
- Begin to follow implicit rules for conversation, (e.g., taking turns and staying on topic).
- Begin to use voice level, phrasing, sentence structure, and intonation appropriate for language situation.
- Listen and speak in informal conversations with peers and adults.
- Begin to initiate conversations.
- Participate in discussions about learning.

K.4 The student will hear, say, and manipulate phonemes (small units of sound) of spoken language.
- Identify orally words which rhyme.
- Sort words orally according to shared beginning, ending, or medial sounds.
- Blend sounds orally to make words or syllables.
- Divide syllables orally into sounds.

Reading/Literature

K.5 The student will understand how print is organized and read.
- Hold print materials in the correct position.
- Identify the front cover, back cover, and title page of a book.
- Follow words from left to right and top to bottom on a printed page.

- Match voice with print associating oral phonemes, syllables, words, and phrases with their written forms.

K.6 The student will demonstrate an understanding that print makes sense.
- Explain that printed materials provide information.
- Identify common signs and logos.
- Read and explain own writing and drawings.

K.7 The student will develop an understanding of basic phonetic principles.
- Understand that letters represent sounds.
- Identify beginning consonants in single-syllable words.
- Recognize rhyming words.

K.8 The student will demonstrate comprehension of stories.
- Use pictures to make predictions about story content.
- Retell familiar stories using beginning, middle, and end.
- Talk about characters, setting, and events.
- Use story language in discussions and retellings.
- Identify what an author does and what an illustrator does.

K.9 The student will identify both uppercase and lowercase letters of the alphabet.

Writing

K.10 The student will print his/her name.

K.11 The student will draw pictures and/or use letters and phonetically spelled words to write about experiences, stories, people, objects, or events.

K.12 The student will explore the uses of available technology for reading and writing.

Research

K.13 The student will begin to ask how and why questions.

Grade One

Students will become independent readers by the end of first grade. The first-grade student will be immersed in a literature-rich environment to develop an awareness of print materials as sources of information and enjoyment. The student will use listening and speaking skills to participate in classroom discussions. The student will use a variety of strategies to read new words and will read familiar selections aloud with fluency and expression. The student will continue to develop an understanding of character, setting, theme, and story sequence in a variety of classic and contemporary storybooks. Understanding the main idea and sequence of events in a story are important comprehension skills that will be applied in math, science, and history and social science where students will complete number patterns to follow directions for simple experiments and will study people, cultures, and important traditions of our country and other countries. The student will demonstrate comprehension of fiction and nonfiction through classroom discussion and will begin to communicate ideas in writing.

Oral Language

1.1 The student will continue to demonstrate growth in the use of oral language.
- Listen and respond to a variety of media, including books, audiotapes, videos, and other age-appropriate publications.
- Tell and retell stories and events in logical order.
- Participate in a variety of oral language activities.
- Be able to express ideas orally in complete sentences.

1.2 The student will continue to expand and use listening and speaking vocabularies.
- Increase oral descriptive vocabulary.
- Begin to ask for clarification and explanation of words and ideas.
- Give and follow simple two-step oral directions.
- Use singular and plural nouns.
- Begin to use compound words in oral communication.

1.3 The student will adapt or change oral language to fit the situation.
- Initiate conversation with peers and adults.
- Follow rules for conversation.
- Use appropriate voice level in small-group settings.
- Ask and respond to questions in small-group settings.

1.4 The student will orally identify and manipulate phonemes (small units of sound) in syllables and multisyllable words.

- Count phonemes (sounds) in syllables or words with a maximum of three syllables.
- Add or delete phonemes (sounds) orally to change syllables or words.
- Create rhyming words orally.
- Blend sounds to make word parts and words with one to three syllables.

Reading/Literature

1.5 The student will apply knowledge of how print is organized and read.
- Read from left to right and top to bottom.
- Match spoken words with print.
- Identify letters, words, and sentences.

1.6 The student will apply phonetic principles to read.
- Use beginning and ending consonants in decoding single-syllable words.
- Use vowel sounds in decoding single-syllable words.
- Blend beginning, middle, and ending sounds to recognize and read words.
- Use word patterns.

1.7 The student will use meaning clues when reading.
- Use pictures.
- Use knowledge of the story and topic to read words.
- Reread and self-correct.

1.8 The student will use language structure when reading.
- Use knowledge of sentence structure to read words.
- Reread and self-correct.

1.9 The student will integrate phonetic strategies, meaning clues, and language structure when reading.
- Preview the selection.
- Set a purpose for reading.
- Read with accuracy and self-correct when necessary.

1.10 The student will read familiar stories, poems, or passages with fluency and expression.

1.11 The student will read and comprehend a variety of fiction and nonfiction selections.
- Relate previous experiences to what is read.
- Make predictions about content.
- Ask and answer questions about what is read.
- Identify characters and setting.
- Retell stories and events, using beginning, middle, and end.
- Identify the theme or main ideas.
- Write about what is read.

Writing

1.12 The student will write to communicate ideas.
- Generate ideas.
- Focus on one topic.
- Use descriptive words when writing about people, places, things, and events.
- Use complete sentences in final copies.
- Begin each sentence with a capital letter and use ending punctuation in final copies.
- Use correct spelling for frequently used words and phonetically regular words in final copies.
- Share writing with others.
- Use available technology.

1.13 The student will print legibly.
- Form letters.
- Space words and sentences.

Research

1.14 The student will alphabetize words according to the first letter.
- Use a picture dictionary to find meanings of unfamiliar words.
- Make a personal dictionary or word list to use in writing.

Grade Two

Reading continues to be a priority in second grade. The student will be immersed in a literature-rich environment, filled with classical and contemporary fiction and, to the extent feasible, nonfiction selections which relate to all areas of learning and interest. The student will be able to speak and listen effectively in classroom discussions, use a combination of strategies when reading, and read with comprehension. Comprehension strategies will be applied in all subjects, as students are asked to identify main ideas, to make and confirm predictions, and to formulate questions about learning. In history and social science, students will use oral and written communication skills to describe the geography and government of their communities and to explain notable contributions of historic individuals and groups of people throughout the world by retelling stories and myths of heroes. The student will

write stories, letters, and simple explanations, apply simple grammatical principles to writing, and locate information in reference materials.

Oral Language

2.1 The student will demonstrate an understanding of oral language structure.
- Create oral stories to share with others.
- Create and participate in oral dramatic activities.
- Use correct verb tenses in oral communication.
- Use increasingly complex sentence structures in oral communication.

2.2 The student will continue to expand listening and speaking vocabularies.
- Use words that reflect a growing range of interests and knowledge.
- Clarify and explain words and ideas orally.
- Give and follow oral directions with three or four steps.
- Identify and use synonyms and antonyms in oral communication.

2.3 The student will use oral communication skills.
- Use oral language for different purposes: to inform, to persuade, and to entertain.
- Share stories or information orally with an audience.
- Participate as a contributor and leader in a group.
- Paraphrase information shared orally by others.

Reading/Literature

2.4 The student will use phonetic strategies when reading and writing.
- Use knowledge of consonants and consonant blends in words.
- Use knowledge of common vowel patterns.

2.5 The student will use meaning clues when reading.
- Use pictures and diagrams.
- Use information in the story to read words.
- Use titles and headings.

2.6 The student will use language structure when reading.
- Use knowledge of prefixes and suffixes.
- Use knowledge of contractions and singular possessives.
- Use knowledge of simple abbreviations.
- Use knowledge of sentence structure.
- Use knowledge of story structure and sequence.

2.7 The student will read fiction, nonfiction, and poetry using a variety of strategies independently.
- Preview the selection.
- Set purpose for reading.
- Use pictures, phonics, meaning clues, and language structure.
- Reread and self-correct when necessary.

2.8 The student will demonstrate comprehension of fiction and nonfiction selections.
- Relate previous experiences to the topic.
- Read to confirm predictions.
- Locate information to answer questions.
- Paraphrase information found in nonfiction materials.
- Describe characters and setting in fiction selections and poetry.
- Explain the problem, solution, or central idea.
- Write about what is read.

Writing

2.9 The student will write stories, letters, and simple explanations.
- Generate ideas before writing.
- Organize writing to include a beginning, middle, and end.
- Revise writing for clarity.
- Use available technology.

2.10 The student will edit final copies for grammar, capitalization, punctuation, and spelling.
- Use declarative, interrogative, and exclamatory sentences.
- Capitalize all proper nouns and words at the beginning of sentences.
- Use correct spelling for frequently used words.

Research

2.11 The student will locate information in reference materials.
- Use a table of contents.
- Examine pictures and charts.
- Use dictionaries and indices.
- Use available technology.

Grade Three

Reading continues to be a priority in third grade. Students will read a variety of literature, with an emphasis on classical as well as contemporary works. The student will use effective communication skills in group activities and will present brief oral reports. Reading comprehension strategies will be applied in all subjects, such as reading and solving word problems in math, investigating a broad array of scientific concepts, and comparing important people and events from the time of earliest civilizations to settlement of the New World. The student will plan, draft, revise, and edit stories, simple explanations, and short reports. In addition, the student will gather and use information from print and nonprint sources. The student also will write legibly in cursive.

Oral Language

3.1 The student will use effective communication skills in group activities.
- Listen attentively by making eye contact, facing the speaker, asking questions, and paraphrasing what is said.
- Ask and respond to questions from teachers and other group members.
- Explain what has been learned.

3.2 The student will present brief oral reports.
- Speak clearly.
- Use appropriate volume and pitch.
- Speak at an understandable rate.
- Organize ideas sequentially or around major points of information.
- Use clear and specific vocabulary to communicate ideas.

Reading/Literature

3.3 The student will apply word-analysis skills when reading and writing.
- Use knowledge of less common vowel patterns.
- Use knowledge of homophones.

3.4 The student will use strategies to read a variety of printed materials (nonfiction, fiction, poetry).
- Preview and use text formats.
- Set a purpose for reading.
- Apply meaning clues, language structure, and phonetic strategies.
- Reread and self-correct when necessary.

3.5 The student will demonstrate comprehension of a variety of printed materials.
- Set a purpose for reading.
- Make connections between previous experiences and reading selections.
- Make, confirm, or revise predictions.
- Ask and answer questions.
- Compare and contrast settings, characters, and events.
- Organize information or events logically.
- Use information to learn about new topics.
- Write about what is read.

3.6 The student will continue to read a variety of fiction and nonfiction selections.
- Identify the characteristics of folk tales.
- Identify the characteristics of biographies and autobiographies.
- Compare and contrast the characters described in two folk tales.
- Compare and contrast the lives of two persons as described in biographies and/or autobiographies.

Writing

3.7 The student will write descriptive paragraphs.
- Develop a plan for writing.
- Focus on a central idea.
- Group related ideas.
- Include descriptive details that elaborate the central idea.
- Revise writing for clarity.
- Edit final copies for grammar, capitalization, punctuation, and spelling.

3.8 The student will write stories, letters, simple explanations, and short reports across all content areas.
- Use a variety of planning strategies.
- Organize information according to the type of writing.
- Revise writing for specific vocabulary and information.
- Edit final copies for grammar, capitalization, punctuation, and spelling.
- Use available technology.

3.9 The student will write legibly in cursive.

Research

3.10 The student will record information from print and nonprint resources.

- Use dictionaries, encyclopedias, and other reference books.
- Use videos, interviews, and cassette recordings.
- Use available technology.

Grade Four

The fourth-grade student will communicate orally in large- and small-group settings. Students will read classics and contemporary literature by a variety of authors. A significant percentage of reading material will relate to the study of math, science, and history and social science. The student will use text organizers, summarize information, and draw conclusions to demonstrate reading comprehension. Reading, writing, and reporting skills support an increased emphasis on content-area learning and on utilizing the resources of the media center, especially to locate and read primary sources of information (speeches and other historical documents) related to the study of Virginia. Students will plan, write, revise, and edit narratives and explanations. The student will routinely use information resources and word references while writing.

Oral Language

4.1 The student will use effective oral communication skills in a variety of settings.

- Present accurate directions to individuals and small groups.
- Contribute to group discussions.
- Seek the ideas and opinions of others.
- Begin to use evidence to support opinions.

4.2 The student will make and listen to oral presentations and reports.

- Use subject-related information and vocabulary.
- Listen to and record information.
- Organize information for clarity.

Reading/Literature

4.3 The student will read and learn the meanings of unfamiliar words.

- Use knowledge of word origins; synonyms, antonyms, and homonyms; and multiple meanings of words.
- Use word-reference materials including the glossary, dictionary, and thesaurus.

4.4 The student will read fiction and nonfiction, including biographies and historical fiction.

- Explain the author's purpose.
- Describe how the choice of language, setting, and information contributes to the author's purpose.
- Compare the use of fact and fantasy in historical fiction with other forms of literature.
- Explain how knowledge of the lives and experiences of individuals in history can relate to individuals who have similar goals or face similar challenges.

4.5 The student will demonstrate comprehension of a variety of literary forms.

- Use text organizers such as type, headings, and graphics to predict and categorize information.
- Formulate questions that might be answered in the selection.
- Make inferences using information from texts.
- Paraphrase content of selection, identifying important ideas and providing details for each important idea.
- Describe relationship between content and previously learned concepts or skills.
- Write about what is read.

4.6 The student will read a variety of poetry.

- Describe the rhyme scheme (approximate, end, and internal).
- Identify the sensory words used and their effect on the reader.
- Write rhymed, unrhymed, and patterned poetry.

Writing

4.7 The student will write effective narratives and explanations.
- Focus on one aspect of a topic.
- Develop a plan for writing.
- Organize writing to convey a central idea.
- Write several related paragraphs on the same topic.
- Utilize elements of style, including word choice, tone, voice, and sentence variation.
- Edit final copies for grammar, capitalization, punctuation, and spelling.
- Use available technology.

4.8 The student will edit final copies of writings.
- Use subject-verb agreement.
- Avoid double negatives.
- Use pronoun "I" correctly in compound subjects.
- Use commas in series, dates, and addresses.

Research

4.9 The student will use information resources to research a topic.
- Construct questions about a topic.
- Collect information, using the resources of the media center.
- Evaluate and synthesize information for use in writing.
- Use available technology.

Grade Five

The fifth-grade student will continue to increase communication skills used in learning activities and will use a variety of resources to prepare presentations. The student will plan, write, revise, and edit writings to describe, to entertain, and to explain. The student will continue to develop an appreciation for literature and build a storehouse of literary experiences and images through careful reading of selections from fiction, nonfiction, and poetry. Students will be introduced to documents and speeches that are important in the study of American history to 1877. The student also will read texts in all subjects and will derive information to answer questions, generate hypotheses, make inferences, support opinions, confirm predictions, and formulate conclusions.

Oral Language

5.1 The student will listen, draw conclusions, and share responses in subject-related group learning activities.
- Participate in and contribute to discussions across content areas.
- Organize information to present reports of group activities.
- Summarize information gathered in group activities.

5.2 The student will use effective nonverbal communication skills.
- Maintain eye contact with listeners.
- Use gestures to support, accentuate, or dramatize verbal message.
- Use facial expressions to support or dramatize verbal message.
- Use posture appropriate for communication setting.

5.3 The student will make planned oral presentations.
- Determine appropriate content for audience.
- Organize content sequentially or around major ideas.
- Summarize main points before or after presentation.
- Incorporate visual aids to support the presentation.

Reading/Literature

5.4 The student will read and learn the meanings of unfamiliar words.
- Use knowledge of root words, prefixes, and suffixes.
- Use dictionary, glossary, thesaurus, and other word-reference materials.

5.5 The student will read a variety of literary forms, including fiction, nonfiction, and poetry.
- Describe character development in fiction and poetry selections.
- Describe the development of plot, and explain how conflicts are resolved.
- Describe the characteristics of free verse, rhymed, and patterned poetry.
- Describe how author's choice of vocabulary and style contribute to the quality and enjoyment of selections.

5.6 The student will demonstrate comprehension of a variety of literary forms.

- Use text organizers such as type, headings, and graphics to predict and categorize information in informational texts.
- Locate information to support opinions, predictions, and conclusions.
- Identify cause-and-effect relationships.
- Prioritize information according to purpose of reading.
- Write about what is read.

Writing

5.7 The student will write for a variety of purposes to describe, to inform, to entertain, and to explain.

- Choose planning strategies for various writing purposes.
- Organize information.
- Use vocabulary effectively.
- Vary sentence structure.
- Revise writing for clarity.
- Edit final copies for grammar, capitalization, spelling, and punctuation, especially the use of possessives and quotation marks.

Research

5.8 The student will synthesize information from a variety of resources.

- Skim materials to develop a general overview of content or to locate specific information.
- Develop notes that include important concepts, paraphrases, summaries, and identification of information sources.
- Organize and record information on charts, maps, and graphs.
- Use available electronic databases to access information.
- Credit secondary reference sources

Computer/Technology Standards by the End of Grade Five

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 5** include the following:

C/T5.1 The student will demonstrate a basic understanding of computer theory, including bits, bytes, and binary logic.

C/T5.2 The student will develop basic technology skills.

- Develop a basic technology vocabulary that includes cursor, software, memory, disk drive, hard drive, and CD-ROM.
- Select and use technology appropriate to tasks.
- Develop basic keyboarding skills.
- Operate peripheral devices.
- Apply technologies to strategies for problem solving and critical thinking.

C/T5.3 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information using databases, CD-ROMs, videodiscs, and telecommunications.
- Use electronic encyclopedias, almanacs, indexes, and catalogs.
- Use local and wide-area networks and modem-delivered services to access information from electronic databases.
- Describe advantages and disadvantages of various computer processing, storage, retrieval, and transmission techniques.

C/T5.4 The student will communicate through application software.

- Create a 1-2 page document using word processing skills, writing process steps, and publishing programs.
- Use simple computer graphics and integrate graphics into word-processed documents.
- Create simple databases and spreadsheets to manage information and create reports.
- Use local and worldwide network communication systems.

Grade Six

The sixth-grade student will be a reflective participant in classroom discussions. The student will present personal opinions and understand differing points of view, distinguish between fact and opinion, and analyze the effectiveness of group communication skills. The student will read a variety of fiction and nonfiction independently for appreciation and comprehension, including a significant number of classic works. Analysis of scientific explanations and comparison of math data sets will require application of critical reading and reasoning skills. Students will read and review primary and secondary source informational texts in the study of American history from 1877 to the present. The student also will plan, draft, revise, and edit narratives, descriptions, and explanations with attention to composition and style, as well as sentence formation, usage, and mechanics. In addition, writing will be used as a tool for learning academic concepts and available technology will be used as appropriate.

Oral Language

6.1 The student will analyze oral participation in small-group activities.
- Communicate as leader and contributor.
- Evaluate own contributions to discussions.
- Summarize and evaluate group activities.
- Analyze the effectiveness of participant interactions.

6.2 The student will listen critically and express opinions in oral presentations.
- Distinguish between facts and opinions.
- Compare and contrast points of view.
- Present a convincing argument.

Reading/Literature

6.3 The student will read and learn the meanings of unfamiliar words.
- Use knowledge of word origins and derivations.
- Use word-reference materials.

6.4 The student will read a variety of fiction (realistic, fantasy, historical, and biographical) and nonfiction (expository and argumentative).
- Use knowledge of literary forms to aid comprehension and predict outcomes.
- Describe how the author's style elicits emotional response from the reader.
- Distinguish between first- and third-person point of view.
- Compare and contrast authors' styles.
- Explain how character and plot development are used in a selection to support a central conflict or story line.

6.5 The student will demonstrate comprehension of a variety of selections.
- Identify questions to be answered.
- Make, confirm, or revise predictions as needed.
- Use context clues to read unfamiliar words.
- Draw conclusions and make inferences based on explicit and implied information.
- Organize information for use in written and oral presentations.
- Compare and contrast information about one topic contained in different selections.

6.6 The student will read and write a variety of poetry.
- Describe the visual images created by language.
- Describe how word choice, speaker, and imagery elicit a response from the reader.
- Compare and contrast plot and character development in narrative poems, short stories, and longer fiction selections.

Writing

6.7 The student will write narratives, descriptions, and explanations.
- Use a variety of planning strategies to generate and organize ideas.
- Establish central idea, organization, elaboration, and unity.
- Select vocabulary and information to enhance the central idea, tone, and voice.
- Expand and embed ideas by using modifiers, standard coordination, and subordination in complete sentences.
- Revise writing for clarity.
- Edit final copies for correct use of language: subject-verb and pronoun-antecedent agreement, consistent tense inflections, and adverb and adjective usage.
- Edit final copies for writing mechanics: format, capitalization, punctuation, and spelling.

6.8 The student will use writing as a tool for learning in all subjects.
- Make lists.
- Paraphrase what is heard or read.
- Summarize what is heard or read.
- Hypothesize.
- Connect knowledge within and across disciplines.
- Synthesize information to construct new concepts.

Research

6.9 The student will select the best sources for a given purpose, including atlases, dictionaries, globes, interviews, telephone directories, encyclopedias, electronic databases, and the *Reader's Guide*.

Grade Seven

The seventh-grade student will continue to develop oral communication skills and will become more knowledgeable of the effects of verbal and nonverbal behaviors in oral communication. The student will continue to refine written composition skills, with special attention to word choice, organization, style, and grammar. Written explanations of math concepts and scientific ecosystems will utilize technical writing skills. The student will continue vocabulary development through a study of figurative language. Knowledge of the impact of media on public opinion will be applied in the study of election processes and policymaking. The student will increase his/her proficiency in the use of print and electronic information resources and will learn how to give credit to secondary reference sources.

Oral Language

7.1 The student will give and seek information in conversations and in group discussions.
- Use oral vocabulary and style appropriate for listeners.
- Communicate ideas and information orally in an organized and succinct manner.
- Ask probing questions to seek elaboration and clarification of ideas.
- Make supportive statements to communicate agreement or acceptance of others' ideas.

7.2 The student will identify the relationship between a speaker's verbal and nonverbal messages.
- Use verbal communication skills, such as word choice, pitch, feeling, tone, and voice.
- Use nonverbal communication skills, such as eye contact, posture, and gestures.
- Compare/contrast a speaker's verbal and nonverbal messages.

7.3 The student will identify persuasive messages in nonprint media, including television, radio, and films.
- Identify persuasive technique used.
- Distinguish between fact and opinion.

Reading/Literature

7.4 The student will use analogies, idioms, similes, and metaphors to extend understanding of word meanings.

7.5 The student will read a variety of fiction, nonfiction, and poetry.
- Describe setting, plot structure, and theme or conflict.
- Analyze relationship between author's style, literary form, and intended impact on reader.
- Describe connections between historical and cultural influences and literary selections.
- Describe how word choice and language structure convey an author's viewpoint in newspaper and magazine articles and critical reviews.

7.6 The student will read and understand information from varied sources.
- Use knowledge of text structures to aid comprehension.
- Make, confirm, or revise predictions as needed.
- Distinguish fact from opinion in newspapers, magazines, and other print media.
- Summarize what is read.
- Organize and synthesize information for use in written and oral presentations.

7.7 The student will read a variety of poetry.

- Compare and contrast the use of a speaker and the impact on the reader.
- Describe the impact of specific word choices, such as jargon, dialect, multiple meanings, invented words, concrete or abstract terms, and sensory or figurative language.
- Explain how sentence structure, line length, and punctuation convey mood or meaning of a poem.
- Describe how rhythm contributes to the purpose or theme of a poem.
- Compare and contrast the rhythm of poems with similar or dissimilar themes.

Writing

7.8 The student will develop narrative, expository, persuasive, and technical writings.

- Apply knowledge of prewriting strategies.
- Elaborate the central idea in an organized manner.
- Choose vocabulary and information that will cause a reader to perceive images and tone.
- Use clauses and phrases to embed context into sentences.
- Revise writing for clarity.
- Edit final copies to ensure correct use of homonyms, pronoun-antecedent agreement, subject-verb agreement, and verb tense consistency.
- Edit final copies to ensure correct spelling, capitalization, punctuation, and format.
- Use available technology.

7.9 The student will use a word processor to plan, draft, revise, and publish some writings.

- Use available word processing tools to check spelling, style, and grammar.

Research

7.10 The student will apply knowledge of resources in preparing written and oral presentations.

- Use print and electronic sources to locate books and articles.
- Use a thesaurus to select more exact descriptive, specific, or effective vocabulary for writing.
- Use graphic organizers to organize information.
- Credit secondary reference sources.

Grade Eight

The eighth-grade student will learn and apply interviewing techniques. The student will plan, draft, revise, and edit writing, with emphasis on narratives, exposition, and persuasion. Students will apply reading and writing skills in all subjects, such as communicating results of scientific experiments, reading and describing the relationship between subsets of the real number system, or describing the characteristics and contributions of early civilizations. The student will become a skillful interpreter of the persuasive strategies used in mass media. The student will continue to develop an appreciation for literature through a study of literary elements contained in classic works as well as contemporary selections. The student will describe themes or inferred main ideas, interpret cause-effect relationships, and draw conclusions from a variety of literary selections.

Oral Language

8.1 The student will use interviewing techniques to gain information.

- Prepare and ask relevant questions for the interview.
- Make notes of responses.
- Compile and report responses.
- Evaluate the effectiveness of the interview.

Reading/Literature

8.2 The student will apply knowledge of word origins, derivations, and idioms and will use analogies, metaphors, and similes to extend vocabulary development.

8.3 The student will apply knowledge of the characteristics and elements of various literary forms, including short stories, essays, speeches, lyric and narrative poems, plays, and novels.

- Explain the use of symbols and figurative language.
- Describe inferred main ideas or themes.
- Describe cause-effect relationships and their impact on plot.
- Describe how authors use characters, point of view, and tone to create meaning.

- Compare and contrast the use of the poetic elements of word choice, dialogue, rhyme, rhythm, and voice.
- Explain how a literary selection can expand or enrich personal viewpoints or experiences.

8.4 The student will comprehend what is read from a variety of sources.

- Draw on background knowledge and knowledge of text structure to understand selections.
- Analyze details for relevance and accuracy.
- Read and follow instructions to assemble a model or simple structure.
- Evaluate and synthesize information to apply in written and oral presentations.

Writing

8.5 The student will write in a variety of forms, including narrative, expository and persuasive writings.

- Use prewriting strategies to generate and organize ideas.
- Focus on elaboration and organization.
- Select specific vocabulary and information.
- Use standard sentence formation, eliminating comma splices and other nonstandard forms of sentences that distract readers.
- Revise writing for word choice, appropriate organization, consistent point of view, and transitions among paragraphs.
- Edit final copies to ensure correct use of pronoun case, verb tense inflections, and adjective and adverb comparisons.
- Edit final copies to ensure correct spelling, capitalization, punctuation, and format.
- Use available technology.

Research

8.6 The student will analyze mass media messages.

- Identify the persuasive technique being used.
- Describe the possible cause-effect relationships between mass media coverage and public opinion trends.
- Evaluate advertisements, editorials, and feature stories for relationships between intent and factual content.

Computer/Technology Standards by the End of Grade Eight

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 8** include the following:

C/T8.1 The student will communicate through application software.

- Compose and edit a multipage document at the keyboard, using word processing skills and the writing process steps.
- Communicate spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data.
- Communicate with databases by defining fields and entering data, sorting, and producing reports in various forms.
- Use advanced publishing software, graphics programs, and scanners to produce page layouts.
- Integrate databases, graphics, and spreadsheets into word-processed documents.

C/T8.2 The student will communicate through networks and telecommunication.

- Use local and worldwide network communication systems.
- Develop hypermedia "home page" documents that can be accessed by worldwide networks.

C/T8.3 The student will have a basic understanding of computer processing, storing, retrieval, and transmission technologies and a practical appreciation of the relevant advantages and disadvantages of various processing, storage, retrieval, and transmission technologies.

C/T8.4 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information.

- Use electronic encyclopedias, almanacs, indexes, and catalogs to retrieve and select relevant information.
- Use laser discs with a computer in an interactive mode.
- Use local and wide-area networks and modem-delivered services to access and retrieve information from electronic databases.
- Use databases to perform research.

Grade Nine

The ninth-grade student will present and critique dramatic readings of literary selections and will continue to develop proficiency in making planned oral presentations. Knowledge of literary terms and forms will be applied in the student's own writing and in the analysis of literature. Students will be introduced to significant literary works from a variety of cultures and eras, from 1000 A.D. to the present. Increased requirements for research and reporting in all subjects are supported by the use of electronic databases and a standard style sheet method to cite reference sources. Writing will encompass narrative, literary, expository, and technical forms, with particular attention to analysis.

Oral Language

9.1 The student will present and critique dramatic readings of literary selections.

- Choose literary form for presentation, such as poems, monologues, scenes from plays, or stories.
- Adapt presentation techniques to fit literary form.
- Use verbal and nonverbal techniques for presentation.
- Evaluate impact of presentation.

9.2 The student will make planned oral presentations.

- Include definitions to increase clarity.
- Use relevant details to support main ideas.
- Illustrate main ideas through anecdotes and examples.
- Cite information sources.
- Make impromptu responses to questions about presentation.

Reading/Literature

9.3 The student will read and analyze a variety of literature.

- Identify the characteristics that distinguish literary forms.
- Use literary terms in describing and analyzing selections.
- Explain the relationships between and among elements of literature: characters, plot, setting, tone, point of view, and theme.
- Explain the relationship between author's style and literary effect.
- Describe the use of images and sounds to elicit the reader's emotions.
- Explain the influence of historical context on the form, style, and point of view of a written work.

9.4 The student will read and analyze a variety of print materials.

- Identify a hypothesis to be confirmed, disproved, or modified.
- Evaluate clarity and accuracy of information.
- Synthesize information from sources and apply it in written and oral presentations.
- Identify questions not answered by a selected text.
- Extend general and specialized vocabulary through reading and writing.
- Read and follow instructions to use computer software, assemble or construct models or equipment, or complete a project.

9.5 The student will read dramatic selections.

- Identify the two basic parts of drama.
- Compare and contrast the elements of character, setting, and plot in one-act plays and full-length plays.
- Describe how stage directions help the reader understand a play's setting, mood, characters, plot, and theme.

Writing

9.6 The student will develop narrative, literary, expository, and technical writings to inform, explain, analyze, or entertain.
- Plan and organize writing.
- Communicate clearly the purpose of the writing.
- Write clear, varied sentences.
- Use specific vocabulary and information.
- Arrange paragraphs into a logical progression.
- Revise writing for clarity.
- Edit final copies for correct use of language, spelling, punctuation, and capitalization.

Research

9.7 The student will credit the sources of both quoted and paraphrased ideas.
- Define the meaning and consequences of plagiarism.
- Distinguish one's own ideas from information created or discovered by others.
- Use a style sheet method for citing secondary sources, such as MLA or APA.

9.8 The student will use electronic databases to access information.
- Identify key terms.
- Narrow the focus of a search.
- Scan and select resources.

Grade Ten

The tenth-grade student will become a skilled communicator in small-group learning activities. The student will read and critique literary works from a variety of eras and cultures, including those cultures studied in world geography.* Attention will be given to the analysis of printed consumer information, such as labels, owners' manuals, warranties, and contracts. Reading analysis skills also will be valuable in understanding geometric theorems. The student will critique the writing of peers and professionals, using analysis to improve his/her writing skills.

* School divisions may elect to teach this body of literature at Grade 11 or 12.

Oral Language

10.1 The student will participate in and report small-group learning activities.
- Assume responsibility for specific tasks.
- Participate in the preparation of an outline or summary of the group activity.
- Include all group members in oral presentation.

10.2 The student will critique oral reports of small-group learning activities.
- Evaluate one's own role in preparation and delivery of oral reports.
- Evaluate effectiveness of group process in preparation and delivery of oral reports.

Reading/Literature

10.3 The student will read and critique literary works from a variety of eras in a variety of cultures.
- Explain similarities and differences of structures and images as represented in the literature of different cultures.
- Identify universal themes prevalent in the literature of all cultures.
- Describe cultural archetypes in short stories, novels, poems, and plays across several cultures.
- Examine a literary selection from several critical perspectives.

10.4 The student will read and interpret printed consumer materials.
- Identify essential information needed to operate specific tools, appliances, technology hardware, or other equipment.
- Analyze the information contained in warranties, contracts, job descriptions, and technical descriptions.
- Skim manuals or consumer texts to locate information.
- Compare and contrast product information contained in advertisements with instruction manuals and warranties.
- Apply the information contained in labels, warnings, manuals, directions, applications, and forms to complete simulated or real-world tasks.

10.5 The student will read and critique a variety of poetry.
- Compare and contrast the use of rhyme, rhythm, and sound to convey a message.

- Compare and contrast the ways in which poets inspire the reader to share emotions expressed in poems.
- Paraphrase the meaning of selected poems.

10.6 The student will read and critique dramatic selections.
- Explain the use of asides.
- Explain the role of a director.
- Compare and contrast character development in a play as compared to other literary forms.

Writing

10.7 The student will develop a variety of writings with an emphasis on exposition.
- Plan and organize ideas for writing.
- Elaborate ideas clearly through word choice and vivid description.
- Write clear, varied sentences.
- Organize ideas into a logical sequence.
- Revise writing for clarity and content of presentation.
- Edit final copies for correct use of language, spelling, punctuation, and capitalization.
- Use available technology.

10.8 The student will critique professional and peer writing.
- Analyze the writing of others.
- Describe how writing accomplishes its intended purpose.
- Suggest how writing might be improved.
- Apply knowledge of critical analysis to writing.

10.9 The student will use writing to interpret, analyze, and evaluate ideas.
- Explain concepts contained in literature and other disciplines.
- Translate concepts into simpler or more easily understood terms.

Research

10.10 The student will collect, evaluate, and organize information.
- Organize information from a variety of sources.
- Verify the accuracy and usefulness of information.
- Use available technology.

Grade Eleven

The eleventh-grade student will be able to make and analyze persuasive oral presentations, with attention to the accuracy of evidence and the effectiveness of delivery. The student's appreciation for literature will be enhanced by the study of American literature, both classic and contemporary.* The student will be able to identify the prevalent themes and characterizations present in American literature which are reflective of the history and culture; furthermore, the student will identify the contributions of other cultures to the development of American literature. The student will be able to write clear and accurate business and technical correspondence and reports for research and other applications in all subjects. The student will develop expository and persuasive compositions by locating, evaluating, synthesizing, and citing applicable information with careful attention to organization and accuracy.

* School divisions may elect to teach this body of literature at Grade 10 or 12.

Oral Language

11.1 The student will make persuasive presentations.
- Organize evidence to support a position.
- Present evidence clearly and convincingly.
- Support and defend ideas and thoughts in public forums.

11.2 The student will analyze and evaluate persuasive presentations.
- Critique the accuracy, relevance, and organization of evidence.
- Critique the clarity and effectiveness of delivery.

Reading/Literature

11.3 The student will read and analyze relationships among American literature, history, and culture.
- Describe contributions of different cultures to the development of American literature.
- Describe the development of American literature in the 17th, 18th, 19th, and 20th centuries.
- Contrast periods in American literature.
- Differentiate among archetypal characters in American literature.
- Describe the major themes in American literature.

- Describe how use of context and language structures conveys an author's point of view in contemporary and historical essays, speeches, and critical reviews.

11.4 The student will read a variety of print material.
- Use information from texts to clarify or refine understanding of academic concepts.
- Read and follow directions to complete an application for college admission, a scholarship, or for employment.
- Read and follow directions to complete a laboratory experiment.
- Extend general and specialized vocabularies for reading and writing.
- Generalize ideas from selections to make predictions about other texts.

11.5 The student will read and critique a variety of poetry.
- Analyze the poetic elements of classic poems.
- Identify the poetic elements and techniques that are most appealing and that make poetry enjoyable.
- Compare and contrast the works of contemporary and past American poets.

11.6 The student will read a variety of dramatic selections.
- Describe the relationship between farce and characterization.
- Describe the dramatic conventions or devices used by playwrights to present selected plays.
- Explain the use of monologue and soliloquy.
- Explain the use of verbal and dramatic irony.

Writing

11.7 The student will write in a variety of forms with an emphasis on persuasion.
- Develop a focus for writing.
- Evaluate and cite applicable information.
- Organize ideas in a logical manner.
- Elaborate ideas clearly and accurately.
- Adapt content, vocabulary, voice, and tone to audience, purpose, and situation.
- Revise writing for accuracy and depth of information.
- Edit final copies for correct use of language, spelling, punctuation, and capitalization.

11.8 The student will write, revise, and edit personal and business correspondence to a standard acceptable in the work place and higher education.
- Apply a variety of planning strategies to generate and organize ideas.
- Organize information to support the purpose of the writing.
- Present information in a logical manner.
- Revise writing for clarity.
- Edit final copies for correct use of language, spelling, punctuation, and capitalization.
- Use available technology.

Research

11.9 The student will analyze, evaluate, synthesize, and organize information from a variety of sources into a documented paper dealing with a question, problem, or issue.
- Narrow a topic.
- Develop a plan for research.
- Collect information to support a thesis.
- Evaluate quality and accuracy of information.
- Synthesize information in a logical sequence.
- Document sources of information using a style sheet format, such as MLA or APA.
- Revise writing for clarity of content.
- Edit final copy for correct use of language, format, spelling, punctuation, and capitalization.
- Use available technology.

Grade Twelve

The twelfth-grade student will use organizational skills, audience awareness, appropriate vocabulary and grammar, and both verbal and nonverbal presentation skills to plan and deliver an effective 5-10 minute oral presentation. The student will analyze British literature and literature of other cultures, with attention to the many classic works which may be studied.* To the extent feasible, selections will include those which relate to other subjects, such as the study of American and Virginia government. Writing will include the production of technical and expository papers, which are organized logically and contain clear and accurate ideas. The student also will produce a well-documented major research paper.

* School divisions may elect to teach this body of literature at Grade 10 or 11.

Oral Language

12.1 The student will make a 5-10 minute formal oral presentation.

- Choose the purpose of the presentation: to defend a position, to entertain an audience, or to explain information.
- Use a well-structured narrative or logical argument.
- Use details, illustrations, statistics, comparisons, and analogies to support purposes.
- Use visual aids or technology to support presentation.

12.2 The student will evaluate formal presentations.

- Critique relationships among purpose, audience, and content of presentations.
- Critique effectiveness of presentations.

Reading/Literature

12.3 The student will analyze the development of British literature and literature of other cultures.

- Recognize major literary forms and techniques.
- Recognize the characteristics of major chronological eras.
- Relate literary works and authors to major themes and issues of their eras.

12.4 The student will read a variety of print material.

- Identify information needed to conduct a laboratory experiment or product evaluation.
- Draw conclusions regarding the quality of a product based on analysis of the accompanying warranty and instruction manual.
- Evaluate the quality of informational texts and technical manuals.
- Read and follow instructions to install a software program.

12.5 The student will read and critique a variety of poetry.

- Explain how the choice of words in a poem fits the speaker.
- Explain how the sound of a poem (rhyme, rhythm, onomatopoeia, repetition, alliteration, assonance, and parallelism) supports the subject and mood.
- Explain how imagery and figures of speech (personification, simile, metaphor) appeal to the reader's senses and experience.
- Compare and contrast traditional and contemporary works of poets from many cultures.

12.6 The student will read and critique dramatic selections from a variety of authors.

- Describe the conflict, plot, climax, and setting.
- Compare and contrast ways in which dialogue and staging contribute to the theme.
- Identify the most effective elements of selected plays.
- Compare and contrast dramatic elements of plays from American, British, and other cultures.

Writing

12.7 The student will develop expository and technical writings.

- Consider audience and purpose when planning for writing.
- Present ideas in a logical sequence.
- Elaborate ideas clearly and accurately.
- Revise writing for depth of information and technique of presentation.
- Edit final copies for correct use of language, spelling, punctuation, and capitalization.

Research

12.8 The student will write documented research papers.

- Evaluate the accuracy and usefulness of information.
- Synthesize information to support the thesis.
- Present information in a logical manner.
- Cite sources of information using a standard method of documentation.
- Edit for correct use of language, capitalization, punctuation, and spelling in final copies.
- Use available technology.

History and Social Science Standards of Learning

for Virginia Public Schools

History and Social Science Standards of Learning

Goals

The study of history and the social sciences is vital in a democratic society. All students need to know and understand our national heritage in order to become informed participants in shaping our nation's future. The History and Social Science Standards of Learning were developed with the assistance of educators, parents, business leaders, and others with an interest in public education.

The History and Social Science Standards of Learning are designed to

- develop the knowledge and skills of history, geography, civics, and economics that enable students to place the people, ideas, and events that have shaped our state and our nation in perspective;
- enable students to understand the basic values, principles, and operation of American constitutional democracy;
- prepare students for informed and responsible citizenship;
- develop students' skills in debate, discussion, and writing; and
- provide students with a framework for continuing education in history and the social sciences.

History

History should be the integrative core of the curriculum, in which both the humanities (such as art and literature) and the social sciences (political science, economics, and geography) come to life. Through the study of history, students can better understand their own society as well as others. By better understanding the relationship between past and present, students will be better equipped to deal with the problems that might arise in the future. Students will understand chronological thinking, the connection between causes and effects and between continuity and change. History enables students to see how people in other times and places have grappled with the fundamental questions of truth, justice, and personal responsibility, to understand that ideas have real consequences, and to realize that events are shaped both by ideas and the actions of individuals.

Geography

The goal of geography instruction is to provide an understanding of the human and physical characteristics of the earth's places and regions, how people of different cultural backgrounds interact with their environment, and how the United States and the student's home community are affected by conditions and events in distant places. Geographic themes include location, place, human environment, movement, and region. Geographic skills include the ability to use maps, globes, and aerial imagery, to interpret graphs, tables, diagrams, and pictures, to observe and record information, and to assess information from various sources.

Civics

The goal of civics instruction is to develop in all students the requisite knowledge and skills for informed, responsible participation in public life. Civics instruction should provide regular opportunities at each grade level for students to develop a basic understanding of politics and government and to practice the skills of good citizenship. Students should develop an understanding of the values and principles of American constitutional democracy. They should be aware of their rights; be willing to fulfill their responsibilities; be able to obtain, understand, and evaluate information relating to the performance of public officials; and be willing to hold those officials accountable.

Economics

The United States is recognized as a leader among the nations of the world in large part because of its economic strength. In order to maintain that strength, American citizens must understand the basic economic principles that underlie the market economy. They must understand how our own economic system works, as well as how other systems work. They must learn to make wise economic decisions about their own lives and become intelligent consumers, employers, and

workers. A solid grounding in economics will help students prepare for the global marketplace and the complex world of tomorrow.

Organizational Framework

Achievement of the History and Social Science Standards will be enhanced by close coordination with the English curriculum. The English Standards require that a high percentage of required reading relate to topics studied in history and the social sciences.

The Board of Education believes that these standards can best be achieved in a curriculum organized substantially along the lines of the framework outlined below. Indeed, consideration of scope and sequence has been an integral part of the process of developing new standards of learning. We believe, for instance, that the two halves of United States and world history should be taught in consecutive grade levels. The Board recognizes, however, that a local school division may wish to adopt a different organizational framework as long as students are able to achieve the required standards.

Kindergarten–Grade Three
  Introduction to History and the Social Sciences
Grade Four
  Virginia Studies: 1607 to Present
Grade Five
  United States History to 1877
Grade Six
  United States History: 1877 to Present
Grade Seven
  Civics and Economics
Grade Eight
  World History to 1000 A.D.
Grade Nine
  World History: 1000 A.D. to Present
Grade Ten
  World Geography
Grade Eleven
  United States History
Grade Twelve
  United States and Virginia Government

Computer/Technology Standards

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines. Skills are identified in this document at grades five and eight.

Kindergarten

Introduction to History and the Social Sciences

The standards for kindergarten students include an introduction to the lives of interesting people in history. During the course of their first year in school, students should learn basic concepts involving historical time sequence, geographic direction, and economic choices. They should use maps and globes to identify and locate some of the places and geographic features that are discussed in rich stories of history. Initial citizenship education should include the importance of following rules and respecting the rights of other people. Students should also have opportunities to learn about national symbols. They should learn how individuals acquire the economic goods and services they need and want. They should learn the concepts of self-control, justice, courage, heroism, and leadership.

History

K.1 The student will understand that history relates to events and people of other times and places by

- identifying examples of past events in legends and historical accounts, including Paul Revere's ride and the stories of Johnny Appleseed, Booker T. Washington, and Betsy Ross;
- identifying examples of interesting Americans through exposure to biographies of important people of the past, including George Washington, Harriet Tubman, Abraham Lincoln, and Davy Crockett; and
- describing the people and events honored in commemorative holidays, including Columbus Day,

Thanksgiving, Independence Day, President's Day, and Lee/Jackson/King Day.

Geography

K.2 The student will compare and contrast the relative location of people, places, and things by
- placing objects using near/far, up/down, left/right, behind/in front; and
- locating land and water on a map using north, east, south, and west.

K.3 The student will use simple maps, globes, and other three-dimensional models to
- become aware of the physical shape of our state and nation; and
- locate areas referenced in historically based legends and stories.

K.4 The student will identify symbols such as
- community symbols (traffic signs, traffic lights, street and highway markers, etc.); and
- map symbols (legend references to land, water, roads, and cities).

Economics

K.5 The student will match simple descriptions of work that people do and the names of those jobs with examples from the local community and historical accounts.

K.6 The student will identify basic economic concepts, including
- the difference between basic needs (food, clothing, and shelter) and wants (luxuries);
- the practice of exchanging money for goods; and
- examples of people saving for the future.

Civics

K.7 The student will demonstrate an understanding that being a good citizen involves important actions by
- taking turns and sharing;
- taking responsibility for certain classroom chores;
- taking care of his/her own things (pencils, clothing, papers, books) and respecting what belongs to others;
- identifying examples of honesty, courage, patriotism, and other admirable character traits seen in American history; and
- identifying examples of rules and the consequences of breaking them.

K.8 The student will identify traditionally patriotic symbols such as
- those associated with America including the flag, the bald eagle, monuments, etc.; and
- those associated with Virginia including the flag, the cardinal, etc.

K.9 The student will learn traditionally patriotic activities, including the Pledge of Allegiance and the Star-Spangled Banner.

Grade One

Introduction to History and the Social Sciences

The standards for first-grade students include comparisons of everyday life and traditions in different places and times. First-grade students should construct simple maps and globes to identify continents and locate places in Virginia and around the world related to their comparative studies of life and culture. First graders should also construct time lines; study economic concepts of scarcity, productive resources, and consumption; learn the value of rights and responsibilities; and help to make and enforce class rules. The student should be encouraged to develop good character through stories that teach such virtues as honesty, truthfulness, kindness, self-discipline, and responsibility.

History

1.1 The student will compare everyday life in different places and times and recognize that people, places, and things change over time through such comparisons as
- current school and community with past school and community; and
- contemporary American life with American life in previous time periods.

1.2 The student will understand through biographies and stories the deeds for which our nation honors leaders from the past, including a variety of political, scien-

tific, social, and military leaders, including Benjamin Franklin, George Washington Carver, Jane Addams, and John Paul Jones.

1.3 The student will study the life of people and events associated with major holidays such as Thanksgiving and the Pilgrims, Independence Day, Flag Day, Veterans' Day, Memorial Day, etc.

1.4 The student will construct time lines to show sequence and change and will identify examples of possible cause and effect.

Geography

1.5 The student will locate the local community, Richmond, the Commonwealth of Virginia, the United States, the seven continents, and the four oceans on a map and a globe.

1.6 The student will construct a simple map of a familiar area incorporating cardinal direction, scale, and map symbols.

1.7 The student will describe how climate, location, and physical surroundings affect the way people live, including their food, clothing, shelter, transportation, and recreation.

1.8 The student will use maps, pictures, and stories to compare the geography of the local community with that of other communities in Virginia, the United States, and the world.

Economics

1.9 The student will describe the differences between human resources (people at work), natural resources (water, soil, wood, coal, etc.), and capital resources (machines, tools, etc.) used to produce different goods or services.

1.10 The student will explain the difference between goods and services and will describe how people are both buyers (consumers) and sellers (producers) of goods and services.

1.11 The student will explain that limits on resources require people to make choices about producing and consuming goods and services.

1.12 The student will simulate the exchange of money for goods and services and will identify ways to save money.

Civics

1.13 The student will describe and compare the making of some class rules by direct democracy (e.g., the entire class votes on the rules) and by representative democracy (e.g., the class elects a smaller group to make the rules).

1.14 The student will identify the bodies of elected representatives responsible for making local, Virginia, and United States laws.

1.15 The student will name the President of the United States and recognize national symbols and traditions of Virginia and the United States such as flags, holidays, and the Pledge of Allegiance.

Grade Two

Introduction to History and the Social Sciences

The standards for second grade introduce students to the heritage and contributions of historic groups of people throughout the world. Second graders should also continue development of map skills and demonstrate enhanced understanding of basic economic concepts. Civics standards include distinguishing the basic functions of government and the officials responsible for each.

History

2.1 The student will study the contributions of ancient Egypt and China which have had an impact on world history, with emphasis on written language, laws, calendars, and architectural monuments such as the Pyramids and the Great Wall of China.

2.2 The student will compare rural, urban, and suburban communities and describe how the local community has changed physically and demographically over time.

2.3 The student will compare the tribes of American Indians in Virginia with nomadic (e.g., Sioux) and settled, agricultural tribes (e.g., Pueblo) in other regions in America.

Geography

2.4 The student will describe our nation as composed of states and locate the following on a map of the United States: Washington, D.C.; the states of Virginia, Maryland, West Virginia, North Carolina, Kentucky, and Tennessee; and major rivers, mountain ranges, and lakes in the United States.

2.5 The student will demonstrate map skills by constructing a simple map of the North American continent, which will include the essential map elements of title, scale, key, directional indicator, and date.

Economics

2.6 The student will explain the interdependence of producers and consumers in a market economy by describing factors that have influenced consumer demand and describing how producers have used natural resources, human resources, and capital resources to produce goods and services in the past and the present.

2.7 The student will identify examples of making economic choices and will explain what is given up when making a choice; distinguish between money and barter economies; and explain the differences between using cash, checks, and credit to purchase goods and services.

2.8 The student will compare different ways that money can increase in value through savings and investment (e.g., bank savings accounts, investments in stocks and bonds, and investments in real estate and other valuable goods).

Civics

2.9 The student will identify examples of the extension of the privileges and responsibilities of citizenship in American history and identify the contributions of individuals and groups, including Abraham Lincoln, Susan B. Anthony, and Martin Luther King, Jr.

2.10 The student will explain the difference between making laws, carrying out laws, and determining if laws have been violated and identify the government bodies that perform these functions at the local, state, and national levels.

Grade Three

Introduction to History and the Social Sciences

The standards for third grade develop an understanding of the elements of civilizations and their interrelationship by studying several early civilizations. Students also learn about the discovery, exploration, and colonization of America. Third graders should apply the concepts of latitude and longitude as they study the geography of Virginia and the United States. The study of economics continues within the context of the historical study of exploration and colonization, and students are expected to learn about economic specialization, taxation, and the influence of transportation and communication on the distribution of goods and services.

History

3.1 The student will explain the term "civilization" and describe the ancient civilizations of Greece and Rome, in terms of geographic features, government, agriculture, architecture, music, art, religion, sports, and roles of men, women, and children.

3.2 The student will describe the discovery of the Americas by Columbus and other European explorers and also the first permanent Spanish, French, and English settlements in North America, with emphasis on the people (explorers and their sponsors), their motivations, the obstacles they encountered, and the successes they achieved.

3.3 The student will describe the settlement of Jamestown and the Virginia colony, with emphasis on economic and other reasons that brought settlers to Virginia, the establishment of representative government, the economy, settlers' interactions with American Indians, and the introduction of slavery into Virginia.

3.4 The student will identify historical cause-and-effect relationships such as colonists establishing governments similar to those that governed those colonists in Europe.

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Geography

3.5 The student will distinguish between meridians of longitude and parallels of latitude and use the equator and prime meridian to identify the Northern, Southern, Eastern, and Western hemispheres and the locations of the ancient civilizations, European nations, and American colonies which the student is studying.

3.6 The student will use maps, tables, graphs, and charts to classify regions with common characteristics, such as deserts.

Economics

3.7 The student will describe the economic specialization and interdependence involved in the production of goods and services in various types of communities in the past.

3.8 The student will explain in simple terms how opportunity cost, scarcity, and price influence economic decision making.

3.9 The student will explain the relationship between taxation and government services.

3.10 The student will describe the impact of changing modes of transportation and communication on the distribution of goods and services.

Civics

3.11 The student will explain the fundamental ideals and principles that form the foundation of our republican form of government including inalienable rights ("life, liberty, and the pursuit of happiness"), the rule of law, justice, and equality under the law.

3.12 The student will explain the interaction between rights and responsibilities; why we have rules, laws, and constitutional mandates to protect rights and make sure responsibilities are carried out; consequences for violating them; and the role of citizenship in promoting them.

3.13 The student will identify examples from history of conflicts over rights, how those conflicts were resolved, and the important people who helped resolve them.

Grade Four

Virginia Studies: 1607 to Present

The standards for fourth-grade students allow them to explore the rich history of Virginia from 1607 to the present. Geographic, economic, and civic concepts continue to be presented within this historic context. Students should use geographic tools to analyze the influence of physical and cultural geography on Virginia history. Fourth graders should also focus on concepts of economic interdependence and the historic ideas that form the foundation of political institutions in Virginia and the United States. Historic and current examples of monetary exchange, credit, and taxation should be compared, and students should begin examination of constitutional documents and the structure and operation of state government.

4.1 The student will explain the impact of geographic factors in the expansion and development of Virginia, with emphasis on

- the location of American Indians, various European settlers, and African slaves; and
- the location and growth of cities in relation to the Atlantic Ocean, the Chesapeake Bay, major rivers, the fall line/fall zone, and the Shenandoah Valley.

4.2 The student will use the concepts of absolute location (e.g., using grid systems) and relative location (e.g., direction, reference to neighboring states, and water features) to

- locate and identify on maps and globes his/her local city or county, Virginia, the other original states, the United States, Western Europe, and West Africa;
- explain how physical characteristics, transportation routes, climate, and specialization influenced the variety of crops, products, and industries and the general patterns of economic growth in Virginia;
- illustrate how communities in Virginia differ in physical features, such as land use, population density, architecture, services, and transportation; and
- construct physical maps and three-dimensional models that include the essential map elements and the geographic regions of Virginia (Tidewater, Piedmont, Ridge and Valley, Allegheny Plateau), and the U.S.

(Coastal Plains, Appalachian Mountains, Interior Lowlands, Great Plains, Rocky Mountains, Basin and Ridge, Coastal Range).

4.3 The student will explain the economic, social, and political life of the Virginia colony, with emphasis on
- its political and economic relationship to England and other nations;
- characteristics and contributions of various groups of people;
- the role of money, banking, saving, and credit in colonial Virginia;
- reasons for, and Virginia's role in, the American Revolution;
- the backgrounds, motivations, and contributions of George Washington, George Wythe, Thomas Jefferson, James Madison, James Monroe, Patrick Henry, and other prominent Virginians in the Revolutionary era; and
- the significance of the Charters of the Virginia Company of London, the Virginia Declaration of Rights, the Virginia Statute of Religious Freedom, and the Declaration of Independence.

4.4 The student will describe the social and political life of Virginians between the Revolutionary War and the end of the Civil War, with emphasis on
- the contributions of Virginians to the establishment of the U.S. Constitution and Bill of Rights, and the success of the new national government;
- conflicts between northern and southern states and within Virginia, including Nat Turner's Rebellion, and events leading to secession; and
- Virginia's role in the Civil War, including major battles and leaders in the Confederate army, including Robert E. Lee, J.E.B. Stuart, and Thomas "Stonewall" Jackson.

4.5 The student will evaluate the social, political, and economic life in Virginia from the Reconstruction Period to the 20th century, with emphasis on
- the Reconstruction Period and its impact on politics and government, the economy, demographics, and public opinion;
- the impact of segregation and Jim Crow laws; and
- the economic and social transition from a rural, agricultural society to a more urban, industrialized society.

4.6 The student will trace the history of Virginia in the 20th century, with emphasis on
- the accomplishments of prominent Virginians, including Woodrow Wilson, Harry F. Byrd, Sr., L. Douglas Wilder, and Arthur Ashe;
- social and political events linked to desegregation and Massive Resistance and their relationship to national history;
- the impact of advances in transportation and communication on migration, economic development, and the integration of Virginia into the U.S. economy and eastern Virginia into the northeast megalopolis;
- the role of money, banking, saving, and credit in contemporary Virginia; and
- the types of taxes collected and the types of services provided by each level of government.

4.7 The student will develop historical analysis skills including
- identifying, analyzing, and making generalizations about the life in Virginia history using primary sources including artifacts, diaries, letters, photographs, art, documents, and newspapers;
- distinguishing fact from fiction by comparing documentary sources on historical figures and events with fictionalized characters and events; and
- summarizing and sequencing major events in Virginia history from 1607 to the present and locating significant places and events on a map.

Grade Five
United States History to 1877

The standards for grade five relate to the history of the United States from Pre-Columbian times until 1877. Fifth graders will continue to learn fundamental concepts in civics, economics, and geography. This course continues in grade six. In these two years, students study United States history in chronological sequence and learn about change and continuity in our history, study documents and speeches that lay the foundation of American ideals and

institutions, and examine the everyday life of people at different times in our history through the use of primary and secondary sources. Teachers are encouraged to use simulations, class debates, projects, or other innovative techniques to make the students' learning experiences lively and memorable. Students should have ample instruction devoted to reviewing and strengthening map and globe skills, skills of using and interpreting information, and historical thinking skills.

5.1 The student will describe life in America before the 17th century by
- identifying and describing the first Americans, their arrival from Asia, where they settled, and how they lived, including Inuits (Eskimos), Anasazi (cliff dwellers), Northwest Indians (Kwakiutl), Plains Indians, Mound builders, Indians of the Eastern forest (Iroquois, etc.), Incas, and Mayans;
- explaining how geography and climate influenced the way various Indian tribes lived; and
- evaluating the impact of native economies on their religions, arts, shelters, and cultures.

5.2 The student will trace the routes and evaluate early explorations of the Americas, in terms of
- the motivations, obstacles, and accomplishments of sponsors and leaders of key expeditions from Spain, France, Portugal, and England;
- the political, economic, and social impact on the American Indians; and
- the economic, ideological, religious, and nationalist forces that led to competition among European powers for control of North America.

5.3 The student will describe colonial America, with emphasis on
- the factors that led to the founding of the colonies, including escape from religious persecution, economic opportunity, release from prison, and military adventure;
- geographic, political, economic, and social contrasts in the three regions of New England, the mid-Atlantic, and the South;
- life in the colonies in the 18th century from the perspective of large landowners, farmers, artisans, women, and slaves;
- the principal economic and political connections between the colonies and England;
- sources of dissatisfaction that led to the American Revolution;
- key individuals and events in the American Revolution including King George, Lord North, Lord Cornwallis, John Adams, Samuel Adams, Paul Revere, Benjamin Franklin, George Washington, Thomas Jefferson, Patrick Henry, and Thomas Paine; and
- major military campaigns of the Revolutionary War and reasons why the colonies were able to defeat the British.

5.4 The student will analyze the United States Constitution and the Bill of Rights, in terms of
- the British and American heritage, including the Magna Carta, the English Bill of Rights, the Mayflower Compact, the Virginia Statute of Religious Freedom, and the Articles of Confederation;
- the philosophy of government expressed in the Declaration of Independence; and
- the powers granted to the Congress, the President, the Supreme Court, and those reserved to the states.

5.5 The student will describe challenges faced by the new United States government, with emphasis on
- the writing of a new Constitution in 1787 and the struggles over ratification and the addition of a Bill of Rights;
- major issues facing Congress and the first four presidents; and
- conflicts between Thomas Jefferson and Alexander Hamilton that resulted in the emergence of two political parties.

5.6 The student will describe growth and change in America from 1801 to 1861, with emphasis on
- territorial exploration, expansion, and settlement, including the Louisiana Purchase, the Lewis and Clark expedition, the acquisition of Florida, Texas, Oregon, and California;
- how the effects of geography, climate, canals and river systems, economic incentives, and frontier spirit influenced the distribution and movement of people, goods, and services;
- the principal relationships between the United States and its neighbors (current Mexico and Canada) and the European powers (including the Monroe Doctrine), and describe how those relationships influenced westward expansion;
- the impact of inventions, including the cotton gin, McCormick reaper, steamboat, and steam locomotive on life in America; and
- the development of money, saving, and credit.

5.7 The student will identify causes, key events, and effects of the Civil War and Reconstruction, with emphasis on
- economic and philosophical differences between the North and South, as exemplified by men such as Daniel Webster and John C. Calhoun;
- events leading to secession and war;
- leaders on both sides of the war including Abraham Lincoln, Ulysses S. Grant, Jefferson Davis, Robert E. Lee, Frederick Douglass, and William Lloyd Garrison;
- critical developments in the war, including major battles, the Emancipation Proclamation, and Lee's surrender at Appomattox;
- life on the battlefield and on the homefront;
- basic provisions and postwar impact of the 13th, 14th, and 15th Amendments to the United States Constitution; and
- the impact of Reconstruction policies on the South.

5.8 The student will interpret patriotic slogans and excerpts from notable speeches and documents in United States history up to 1877, including "Give me liberty or give me death," "Remember the Alamo," "E Pluribus Unum," the Gettysburg Address, the Preamble to the Constitution, and the Declaration of Independence.

5.9 The student will develop skills for historical analysis, including the ability to
- identify, analyze, and interpret primary sources (artifacts, diaries, letters, photographs, art, documents, and newspapers) and contemporary media (television, movies, and computer information systems) to better understand events and life in United States history to 1877;
- construct various time lines of American history from pre-Columbian times to 1877 highlighting landmark dates, technological changes, major political and military events, and major historical figures; and
- locate on a United States map major physical features, bodies of water, exploration and trade routes, the states that entered the union up to 1877, and identify the states that formed the Confederacy during the Civil War.

5.10 The student will develop skills in discussion, debate, and persuasive writing by analyzing historical situations and events, including
- different historical perspectives such as American Indians and settlers, slaves and slave holders, Patriots and Tories, Federalists and Anti-Federalists, Rebels and Yankees, Republicans and Democrats, farmers and city folks, etc.; and
- different evaluations of the causes, costs, and benefits of major events in American history up to 1877 such as the American Revolution, the Constitutional Convention, the Civil War, Reconstruction, etc.

Computer/Technology Standards by the End of Grade Five

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 5** include the following:

C/T5.1 The student will demonstrate a basic understanding of computer theory including bits, bytes, and binary logic.

C/T5.2 The student will develop basic technology skills.
- Develop a basic technology vocabulary that includes cursor, software, memory, disk drive, hard drive, and CD-ROM.
- Select and use technology appropriate to tasks.
- Develop basic keyboarding skills.
- Operate peripheral devices.
- Apply technologies to strategies for problem solving and critical thinking.

C/T5.3 The student will process, store, retrieve, and transmit electronic information.
- Use search strategies to retrieve electronic information using databases, CD-ROMs, videodiscs, and telecommunications.

- Use electronic encyclopedias, almanacs, indexes, and catalogs.
- Use local and wide-area networks and modem-delivered services to access information from electronic databases.
- Describe advantages and disadvantages of various computer processing, storage, retrieval, and transmission techniques.

C/T5.4 The student will communicate through application software.

- Create a 1-2 page document using word processing skills, writing process steps, and publishing programs.
- Use simple computer graphics and integrate graphics into word-processed documents.
- Create simple databases and spreadsheets to manage information and create reports.
- Use local and worldwide network communication systems.

Grade Six

United States History: 1877 to the Present

The standards for grade six relate to the history of the United States from the end of the Reconstruction period to the present day, thus completing a two-year study of American history in the elementary grades. Sixth graders should continue to learn fundamental concepts in civics, economics, and geography in the context of United States history. Teachers are encouraged to use simulations, class debates, projects, or other innovative techniques to make the students' learning experiences lively and memorable. Students should have ample instruction devoted to reviewing and strengthening map and globe skills, skills in interpreting and using information, and historical thinking skills.

6.1 The student will explain how, following the Civil War, massive immigration, combined with the rise of big business, heavy industry, and mechanized farming transformed American life, with emphasis on

- Western settlement and changing federal policy toward the Indians;
- why various immigrant groups came to America, some of the obstacles they faced, and the important contributions they made; and
- the growth of American cities, including the impact of racial and ethnic conflict and the role of political machines.

6.2 The student will analyze and explain Americans' responses to industrialization and urbanization, with emphasis on

- muckraking literature and the rise of the Progressive Movement;
- women's suffrage and temperance movements, and their impact on society;
- child labor, working conditions, and the rise of organized labor;
- political changes at the local, state, and national levels; and
- improvements in standards of living, life expectancy, and living conditions.

6.3 The student will describe and analyze the changing role of the United States in world affairs between 1898 and 1930, with emphasis on

- the Spanish-American War;
- the Panama Canal;
- Theodore Roosevelt's "Big Stick Diplomacy;"
- the United States' role in World War I;
- the League of Nations; and
- tariff barriers to world trade.

6.4 The student will describe the ideas and events of the 1920's and 1930's, with emphasis on

- music, dance, and entertainment
- the Harlem Renaissance;
- impact of the automobile;
- prohibition, speakeasies, and bootlegging;
- the impact of women's suffrage;
- racial tensions and labor strife; and
- urban and rural electrification.

6.5 The student will explain the Great Depression and its effects, with emphasis on
- weaknesses in the economy, the collapse of financial markets in the late 1920's, and other events that triggered the Great Crash;
- the extent and depth of business failures, unemployment, and poverty;
- the New Deal and its impact on the Depression and the future role of government in the economy; and
- personalities and leaders of the period, including Will Rogers, Eleanor and Franklin Roosevelt, and Charles Lindbergh.

6.6 The student will analyze and explain the major causes, events, personalities, and effects of World War II, with emphasis on
- the rise of Fascism, Nazism, and Communism in the 1930's and 1940's and the response of Europe and the United States;
- aggression in Europe and the Pacific;
- failure of the policy of appeasement;
- the Holocaust;
- major battles of World War II and the reasons for Allied victory; and
- major changes in Eastern Europe, China, Southeast Asia, and Africa following the war.

6.7 The student will describe the economic, social, and political transformation of the United States since World War II, with emphasis on
- segregation, desegregation, and the Civil Rights Movement;
- the changing role of women in America;
- the technology revolution and its impact on communication, transportation, and new industries;
- the consumer economy and increasing global markets;
- increases in violent crime and illegal drugs;
- effects of increased immigration;
- the impact of governmental social and economic programs and the Cold War on the growth of federal income tax revenues and government spending and the role of the Federal Reserve System;
- effects of organized religious activism; and
- political leaders of the period, trends in national elections, and differences between the two major political parties.

6.8 The student will describe United States foreign policy since World War II, with emphasis on
- the Cold War and the policy of communist containment;
- confrontations with the Soviet Union in Berlin and Cuba;
- nuclear weapons and the arms race;
- McCarthyism and the fear of communist influence within the United States;
- NATO and other alliances, and our role in the United Nations;
- military conflicts in Korea, Vietnam, and the Middle East; and
- the collapse of communism in Europe and the rise of new challenges.

6.9 The student will interpret patriotic slogans and excerpts from notable speeches in United States history since 1877 including "Ask not what your country can do for you, . . ." ". . . December 7, 1941, a date which will live in infamy," "I have a dream . . .," and "Mr. Gorbachev, tear down this wall!"

6.10 The student will develop skills for historical analysis, including the ability to
- identify, analyze, and interpret primary sources (artifacts, diaries, letters, photographs, art, documents, and newspapers) and contemporary media (computer information systems) and to make generalizations about events and life in United States history since 1877;
- recognize and explain how different points of view have been influenced by nationalism, race, religion, and ethnicity;
- distinguish fact from fiction by examining documentary sources;
- construct various time lines of United States history since 1877 including landmark dates, technological and economic changes, social movements, military conflicts, and presidential elections; and
- locate on a United States map all 50 states, the original 13 states, the states that formed the Confederacy, and the states which entered the Union since 1877.

6.11 The student will develop skills in discussion, debate, and persuasive writing by evaluating different assessments of the causes, costs, and benefits of major events in recent American history such as World War I, the New Deal, World War II, the Korean War, the Conservative Movement, the Civil Rights Movement, the War on Poverty, and the Vietnam War.

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Grade Seven
Civics and Economics

The standards for seventh-grade students cover the role of the citizen in the American political and economic systems. The focus is on gaining essential knowledge of the U.S. and Virginia Constitutions and the structure and functions of government institutions at the national, state, and local levels. Students also learn the basic principles, structure, and operation of the American economy. These standards are intended to foster patriotism, respect for the law, a sense of civic duty, and informed economic decision making. Social science skill development extends into quantitative data organization and interpretation.

7.1 The student will compare the Charters of the Virginia Company of London, the Virginia Declaration of Rights, the Virginia Statute of Religious Freedom, the Declaration of Independence, the Articles of Confederation, and the Constitutions of the United States and Virginia, as amended, with emphasis on their treatment of

- fundamental political principles including constitutionalism and limited government, rule of law, democracy and republicanism, sovereignty, consent of the governed, separation of powers, checks and balances, and federalism; and
- fundamental liberties, rights, and values including religion, speech, press, assembly and petition, due process, equality under the law, individual worth and dignity, majority rule and minority rights, etc.

7.2 The student will compare the national, state, and local governments, with emphasis on

- their structures, functions, and powers;
- the election and appointment of officials;
- the division and sharing of powers among levels of government;
- the separation and sharing of powers within levels of government; and
- the process of amending the United States and Virginia Constitutions.

7.3 The student will compare the election process at the local, state, and national levels of government, with emphasis on

- nomination and promotion of candidates for elective office;
- similarities and differences between the major political parties;
- voter turnout;
- evaluating accuracy of campaign advertising; and
- distinguishing between reporting, analysis, and editorializing in the media, and recognition of bias.

7.4 The student will compare the policy-making process at the local, state, and national levels of government, with emphasis on

- the basic law-making process within the respective legislative bodies;
- the interaction between the chief executives and the legislative bodies;
- the functions of departments, agencies, and regulatory bodies;
- the roles of political parties at the state and national levels;
- the ways that individuals and cultural, ethnic, and other interest groups can influence government policymakers; and
- the impact of the media on public opinion and policymakers.

7.5 The student will distinguish between the judicial systems established by the Virginia and United States Constitutions, with emphasis on

- the organization and jurisdiction of Virginia and United States courts;
- the exercise of the power of judicial review;
- the process of bringing and resolving criminal and civil cases in Virginia's judicial system; and
- the function and process of the juvenile justice system in Virginia.

7.6 The student will explain the structure and operation of the United States economy as compared with other economies, with emphasis on

- the basic concepts of free market, as described by Adam Smith, and of communism, as described by Karl Marx;
- the concepts of supply and demand, scarcity, choices, trade-offs, private ownership, incentives, consumer sovereignty, markets, and competition;
- private and public financial institutions;

- the economic impact of consumption, saving and investment, and borrowing by individuals, firms, and governments; and
- the differences between free market, centrally planned, and mixed economies.

7.7 The student will describe the role of governments in the United States economy, with emphasis on
- provision of public goods and services;
- protection of consumer rights, contracts, and property rights;
- the impact of government taxation, borrowing, and spending on individuals and on the production and distribution of goods and services; and
- the role of the Federal Reserve System and the impact of monetary policy on the money supply and interest rates.

7.8 The student will compare the American political and economic system to systems of other nations, including Japan, China, and leading Western European nations, in terms of
- governmental structures and powers;
- the degree of governmental control over the economy; and
- entrepreneurship, productivity, and standards of living.

7.9 The student will demonstrate an understanding of the rights and responsibilities of citizens in America by
- describing ways individuals participate in the political process, such as registering and voting, communicating with government officials, participating in political campaigns, serving on juries and in voluntary appointed positions;
- describing and evaluating common forms of credit, savings, investments, purchases, contractual agreements, warranties, and guarantees; and
- analyzing career opportunities, in terms of individual abilities, skills, and education, and the changing supply and demand for those skills in the economy.

7.10 The student will interpret maps, tables, diagrams, charts, political cartoons, and basic indicators of economic performance (gross domestic product, consumer price index, productivity, index of leading economic indicators, etc.) for understanding of economic and political issues.

Grade Eight
World History to 1000 A.D.

The standards for the eighth grade enable students to explore the historical development of people, places, and patterns of life from ancient times until about 1000 A.D. Students study the origins of much of our heritage using texts, maps, pictures, stories, diagrams, charts, chronological skills, inquiry/research skills, and technology skills.

8.1 The student will describe early physical and cultural development of mankind from the Paleolithic Era to the revolution of agriculture, with emphasis on
- the impact of geography on hunter-gatherer societies;
- characteristics of hunter-gatherer societies;
- toolmaking and use of fire;
- technological and social advancements that gave rise to stable communities; and
- how archeological discoveries are changing our knowledge of early peoples.

8.2 The student will compare selected ancient river civilizations, including Egypt, Mesopotamia, the Indus Valley, and Shang China, and other ancient civilizations (such as the Hebrew and Phoenician kingdoms and the Persian Empire), in terms of
- location in time and place;
- the development of social, political, and economic patterns;
- the development of religious traditions; and
- the development of language and writing.

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8.3 The student will describe, analyze, and evaluate the history of ancient Greece from about 2000 to 300 B.C., in terms of its impact on Western civilization, with emphasis on

- the influence of geography on Greek economic, social, and political development;
- Greek mythology and religion;
- the impact of Greek commerce and colonies on the Mediterranean region;
- the social structure, significance of citizenship, and development of democracy in the city-state of Athens;
- the significance of the Persian Wars and the Peloponnesian Wars;
- life in Athens during the Golden Age of Pericles;
- the contributions of Greek philosophers (including Socrates, Plato, and Aristotle), playwrights, poets, historians, sculptors, architects, scientists, and mathematicians; and
- the conquest of Greece by Macedonia, and the spread of Hellenistic culture by Alexander the Great.

8.4 The student will describe, analyze, and evaluate the history of ancient Rome from about 700 B.C. to 500 A.D., in terms of its impact on Western civilization, with emphasis on

- the influence of geography on Roman economic, social, and political development;
- Roman mythology and religion;
- the social structure, significance of citizenship, and the development of democratic features in the government of the Roman Republic;
- Roman military domination of the Mediterranean basin and Western Europe and the spread of Roman culture in these areas;
- the roles of Julius and Augustus Caesar and the impact of military conquests on the army, economy, and social structure of Rome;
- the collapse of the Republic and the rise of imperial monarchs;
- the economic, social, and political impact of the Pax Romana;
- the origin, traditions, customs, beliefs, and spread of Christianity;
- the origin, traditions, customs, beliefs, and spread of Judaism;
- the development and significance of the Catholic Church in the late Roman Empire;
- contributions in art and architecture, technology and science, literature and history, language, religious institutions, and law; and
- the reasons for the decline and fall of the Roman Empire.

8.5 The student will analyze the conflict between the Muslim world and Christendom from the 7th to the 11th century A.D., in terms of its impact on Western civilization, with emphasis on

- the origin, traditions, customs, beliefs, and spread of Islam;
- theological differences between Islam and Christianity;
- cultural differences between Muslims and Christians;
- religious, political, and economic competition in the Mediterranean region; and
- historical turning points that affected the spread and influence of both religious cultures.

8.6 The student will describe, analyze, and evaluate the history of the Byzantine Empire and Russia from about 300 to 1000 A.D., in terms of its impact on Western civilization, with emphasis on

- the establishment of Constantinople as the capital of the Roman Empire;
- the expansion of the Byzantine Empire and economy;
- codification of Roman law and preservation of Greek and Roman traditions;
- conflicts that led to a split between the Roman Catholic and Greek Orthodox churches;
- Byzantine art and architecture; and
- Byzantine influence on Russia and Eastern Europe.

8.7 The student will describe, analyze, and evaluate the history of Europe during the Middle Ages from about 500 to 1000 A.D., in terms of its impact on Western civilization, with emphasis on

- the structure of feudal society and its economic, social, and political effects;
- the Age of Charlemagne and the revival of the idea of the Roman Empire;
- the invasions and settlements of the Magyars and the Vikings, including Angles and Saxons in Britain; and
- the spread and influence of Christianity throughout Europe.

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8.8 The student will describe and compare selected civilizations in Asia, Africa, and the Americas, in terms of chronology, location, geography, social structures, form of government, economy, religion, and contribution to later civilizations, including

- India, with emphasis on the caste system; the traditions, customs, beliefs, and significance of Hinduism; and the conquest by Moslem Turks;
- China, with emphasis on the T'ang dynasty; the traditions, customs, beliefs, and significance of Buddhism; the impact of Confucianism and Taoism; and the construction of the Great Wall;
- Japan, with emphasis on the development and significance of Shinto and Buddhist religious traditions, and the influence of Chinese culture;
- the kingdoms of Kush in eastern Africa and Ghana in western Africa; and
- the Mayan and Aztec civilizations.

8.9 The student will give examples of the practice of slavery from the earliest civilizations to 1000 A.D.

8.10 The student will improve skills in historical research and geographical analysis by

- identifying, analyzing, and interpreting primary sources and secondary sources to make generalizations about events and life in world history up to 1000 A.D.;
- identifying, analyzing, and interpreting global population distribution in the Middle Ages;
- identifying and comparing contemporary national political boundaries with the location of civilizations, empires, and kingdoms from 4000 B.C. to 1000 A.D.; and
- identifying and comparing the distribution of major religious cultures in the contemporary world with the origin and spread of Judaism, Christianity, Islam, Hinduism, and Buddhism up to 1000 A.D.

Computer/Technology Standards by the End of Grade Eight

Computer/Technology skills are essential components of every student's education. In order to maximize opportunities for students to acquire necessary skills for academic success, the teaching of these skills should be the shared responsibility of teachers of all disciplines.

Minimum skills that students should acquire by the end of **Grade 8** include the following:

C/T8.1 The student will communicate through application software.

- Compose and edit a multi page document at the keyboard, using word processing skills and writing process steps.
- Communicate with spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data.
- Communicate with databases by defining fields and entering data, sorting, and producing reports in various forms.
- Use advanced publishing software, graphics programs, and scanners to produce page layouts.
- Integrate databases, graphics, and spreadsheets into word-processed documents.

C/T8.2 The student will communicate through networks and telecommunication.

- Use local and worldwide network communication systems.
- Develop hypermedia "home page" documents that can be accessed by worldwide networks.

C/T8.3 The student will have a basic understanding of computer processing, storing, retrieval and transmission technologies and a practical appreciation of the relevant advantages and disadvantages of various processing, storage, retrieval, and transmission technologies.

C/T8.4 The student will process, store, retrieve, and transmit electronic information.

- Use search strategies to retrieve electronic information.
- Use electronic encyclopedias, almanacs, indexes,

and catalogs to retrieve and select relevant information.
- Use laser discs with a computer in an interactive mode.
- Use local and wide-area networks and modem-delivered services to access and retrieve information from electronic databases.
- Use databases to perform research.

Grade Nine

World History: 1000 A.D. to the Present

The standards for ninth-grade students cover history and geography from the late Middle Ages (1000 A.D.) to the present with emphasis on Western Europe. Geographic influences on history continue to be explored, but increasing attention is given to political boundaries that developed with the evolution of nation-states. Significant attention will be given to the ways in which scientific and technological revolutions created new economic conditions that in turn produced social and political changes. The people and events of the nineteenth and twentieth centuries will be emphasized for their strong connections to contemporary issues. The standards strike a balance between the broad themes of history and the probing of specific historic events, ideas, issues, persons, and documents. Using texts, maps, pictures, stories, diagrams, charts, and a variety of chronological, inquiry/research, and technological skills, students develop competence in chronological thinking, historical comprehension, and historical analysis.

9.1 The student will demonstrate an understanding of the state of the world about 1000 A.D. by summarizing
- the institution of feudalism in Europe and the rise of towns and commerce;
- the location and leadership of major Western European kingdoms;
- the location and culture of the Byzantine and Muslim empires;
- the location and culture of empires in India, China, Japan, sub-Saharan Africa, and Central America;
- the role of the Roman Catholic Church in Europe; and
- the conflict between Christian and Muslim cultures.

9.2 The student will analyze the patterns of social, economic, and political change and cultural achievement in the late Medieval period, including
- the emergence of nation-states (Spain, France, England, Russia) and distinctive political developments in each;
- conflicts among Eurasian powers including the Crusades, the Mongol conquests, and the expansion of the Ottoman Turks;
- patterns of crisis and recovery including the Black Death; and
- the preservation of Greek and Roman philosophy, medicine, and science.

9.3 The student will analyze the historical developments of the Renaissance, including
- economic foundations of the Renaissance, including European interaction with Muslims, increased trade, role of the Medicis, and new economic practices;
- the rise of Italian city-states;
- artistic, literary, and intellectual creativity, including Leonardo DaVinci, Michelangelo, and Shakespeare, as contrasted with the Medieval period;
- Machiavelli's theory of government as described in The Prince; and
- differences between the Italian and the Northern Renaissance.

9.4 The student will analyze the historical developments of the Reformation, including
- the effects of the theological, political, and economic differences that emerged during the Reformation, including the views and actions of Martin Luther, John Calvin, Henry VIII and the divorce issue;

- the influence of religious conflicts on government actions, including the Edict of Nantes in France; and
- the evolution of laws that reflect religious beliefs, cultural values, traditions, and philosophies, including the beginnings of religious toleration and the spread of democracy.

9.5 The student will analyze the impact of European expansion into the Americas, Africa, and Asia (16th through 19th centuries), in terms of

- the roles of explorers/conquistadors;
- migration, settlement patterns, and cultural diffusion;
- the exchange of technology, ideas, and agricultural practices;
- the trade in slaves, tobacco, rum, furs, and gold;
- the introduction of new diseases;
- the influence of Christianity;
- economic and cultural transformations (e.g., plants like tobacco and corn became available in new places, arrival of the horse in the Americas, etc.);
- competition for resources and the rise of mercantilism;
- the commercial and maritime growth of European nations, including the emergence of money and banking, global economies, and market systems; and
- social classes in the colonized areas.

9.6 The student will compare Judaism, Christianity, Islam, Buddhism, and Hinduism, in terms of

- major leaders and events;
- sacred writings;
- traditions, customs, and beliefs;
- monotheistic versus polytheistic views;
- geographic distribution at different times;
- political, social, and economic influences of each; and
- long-standing religious conflicts and recent manifestations (e.g., Ireland, Middle East conflict, Bosnia, etc.).

9.7 The student will analyze the scientific, political, and economic changes of the 16th, 17th, and 18th centuries (Age of Absolutism, the Enlightenment, and the Age of Reason), in terms of

- the establishment of absolute monarchies by Louis XIV, Frederick the Great, and Peter the Great;
- the Glorious Revolution in England and the French Revolution;
- the ideas of significant people, including Hobbes, Locke, Montesquieu, Rousseau, and Jefferson;
- how the political ideas of the Enlightenment and the ideas of religion affected the founders of the United States;
- new scientific theories, including those of Newton, Kepler, Copernicus, Galileo, and others (e.g., Harvey, Franklin);
- how technological changes brought about social, political, and cultural changes in Europe, Asia, and the Americas;
- the flowering of the arts, philosophy, and literature (e.g., Voltaire, Diderot, Delacroix, Bach, and Mozart); and
- the influence of religious beliefs on art, politics, science, and commerce.

9.8 The student will describe political developments in Europe in the 19th century, including

- the Congress of Vienna;
- expansion of democracy in Europe, including the effects of urbanization, revolutions of 1848, and British reform laws;
- unification of Germany and the role of Bismarck; and
- unification of Italy and the role of Garibaldi.

9.9 The student will analyze and explain the effects of the Industrial Revolution, in terms of

- the rise of industrial economies and their link to imperialism and colonialism;
- how scientific and technological changes, including the inventions of Watt, Bessemer, and Whitney, brought about massive social and cultural change;
- the emergence of capitalism and free enterprise as a dominant economic pattern;
- responses to capitalism including utopianism, socialism, and communism;
- how the status of women and children reflected changes in society;
- the evolution of work and labor, including the slave trade, mining and manufacturing, and the union movement;
- applying economic reasoning and cost-benefit analysis to societal issues; and
- the transformation of Asia and Africa by expanding European commercial power.

9.10 The student will analyze major historical events of the 20th century, in terms of

- causes and effects of World War I and World War II;
- the Russian Revolution;
- the rise, aggression, and human costs of totalitarian regimes in the Soviet Union, Germany, Italy, and Japan;

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- the political, social, and economic impact of worldwide depression in the 1930's;
- the Nazi Holocaust and other examples of genocide;
- new technologies, including atomic power, and their influence on the patterns of conflict;
- economic and military power shifts since 1945, including the rise of Germany and Japan as economic powers;
- revolutionary movements in Asia and their leaders, including Mao Zedong and Ho Chi Minh;
- how African and Asian countries achieved independence from European colonial rule, including India under Gandhi and Kenya under Kenyatta and how they have fared under self-rule;
- regional and political conflicts including Korea and Vietnam; and
- the beginning and end of the Cold War and the collapse of the Soviet Union.

9.11 The student will demonstrate skills in historical research and geographical analysis by
- identifying, analyzing, and interpreting primary and secondary sources and artifacts;
- validating sources as to their authenticity, authority, credibility, and possible bias;
- comparing trends in global population distribution since the 10th century;
- constructing various time lines of key events, periods, and personalities since the 10th century;
- identifying and analyzing major shifts in national political boundaries in Europe since 1815; and
- identifying the distribution of major religious cultures in the contemporary world.

Grade Ten
World Geography

The focus of this course is the study of the world's people, places, and environments with historical emphasis on Asia, Latin America, Africa, and the Middle East. The knowledge, skills, and perspectives of the course are centered on the world's population and cultural characteristics, its countries and regions, land forms and climates, natural resources and natural hazards, economic and political systems, and migration and settlement patterns. Spatial concepts of geography will be linked to chronological concepts of history to set a framework for studying human interactions. The course will emphasize how people in various cultures influence and are influenced by their physical and ecological environments. Using texts, maps, globes, graphs, pictures, stories, diagrams, charts, and a variety of geographic, inquiry/research, and technology skills, students consider the relationships between people and places while asking and answering geographic questions.

10.1 The student will use maps, globes, photographs, and pictures to analyze the physical and human landscapes of the world in order to
- recognize the different map projections and explain the concept of distortion;
- show how maps reflect particular historical and political perspectives;
- apply the concepts of scale, orientation, latitude and longitude;
- create and compare political, physical, and thematic maps of countries and regions; and
- identify regional climatic patterns and weather phenomena and relate them to events in the contemporary world.

10.2 The student will analyze how selected physical and ecological processes shape the Earth's surface, in terms of
- how humans influence and are influenced by the environment; and
- how people's ideas and relationship to the environment change over time, particularly in response to new technologies.

10.3 The student will explain how
- geographic regions change over time;
- characteristics of regions have led to regional labels;
- regional landscapes reflect the cultural characteristics of their inhabitants as well as historical events; and
- technological advances have led to increasing interaction among regions.

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10.4 The student will analyze how certain cultural characteristics can link or divide regions, in terms of language, ethnic heritage, religion, political philosophy, social and economic systems, and shared history.

10.5 The student will compare and contrast the distribution, growth rates, and characteristics of human population, in terms of settlement patterns and the location of natural and capital resources.

10.6 The student will analyze past and present trends in human migration and cultural interaction as they are influenced by social, economic, political, and environmental factors.

10.7 The student will locate and identify by name the major countries in each region and the world's major rivers, mountain ranges, and surrounding bodies of water.

10.8 The student will identify natural hazards, describe their characteristics, explain their impact on human and physical systems, and assess efforts to manage their consequences in developed and less developed regions.

10.9 The student will identify natural, human, and capital resources, describe their distribution, and explain their significance, in terms of location of contemporary and selected historical economic and land-use regions.

10.10 The student will analyze the patterns of urban development, in terms of site and situation, the function of towns and cities, and problems related to human mobility, social structure, and the environment.

10.11 The student will analyze the regional development of Asia, Africa, the Middle East, Latin America, and the Caribbean, in terms of physical, economic, and cultural characteristics and historical evolution from 1000 A.D. to the present.

10.12 The student will analyze the patterns and networks of economic interdependence, with emphasis on formation of multi national economic unions, international trade, and the theory of competitive advantage, in terms of job specialization, competition for resources, and access to labor, technology, transportation, and communications.

10.13 The student will distinguish between developed and developing countries and relate the level of economic development to the quality of life.

10.14 The student will analyze the forces of conflict and cooperation as they influence

- the way in which the world is divided among independent countries and dependencies;
- disputes over borders, resources, and settlement areas;
- the historic and future ability of nations to survive and prosper; and
- the role of multinational organizations.

10.15 The student will apply geography to interpret the past, understand the present, and plan for the future by

- using a variety of maps, charts, and documents to explain historical migration of people, expansion and disintegration of empires, and the growth of economic systems; and
- relating current events to the physical and human characteristics of places and regions.

Grade Eleven
United States History

The standards for eleventh-grade students cover the historical development of American ideas and institutions from the Age of Exploration to the present. While focusing on political and economic history, the standards provide students with a basic knowledge of American culture through a chronological survey of major issues, movements, people, and events in United States and Virginia history.

11.1 The student will analyze and explain the contacts between American Indians and European settlers during the Age of Discovery, in terms of

- economic and cultural characteristics of the groups;
- motives and strategies of the explorers and settlers;
- impact of European settlement on the American Indians; and
- legacies of contact, cooperation, and conflict from that period.

11.2 The student will compare the colonization of Virginia with that of other American colonies, in terms of
- motivations of ethnic, religious, and other immigrants and their influences on the settlement of colonies;
- economic activity;
- political developments; and
- social customs, the arts, and religious beliefs.

11.3 The student will analyze and explain events and ideas of the Revolutionary Period, with emphasis on
- changes in British policies that provoked the American colonists;
- the debate within America concerning separation from Britain;
- the Declaration of Independence and "Common Sense;"
- individuals, including Virginians, who provided leadership in the Revolution; and
- key battles, military turning points, and key strategic decisions.

11.4 The student will analyze the events and ideas of the Constitutional Era, with emphasis on
- new constitutions in Virginia and other states, the Virginia Statute of Religious Freedom, the Virginia Declaration of Rights, and the Articles of Confederation;
- issues and policies affecting relations among existing and future states, including the Northwest Ordinance;
- the Constitutional Convention, including the leadership of James Madison and George Washington;
- the struggle for ratification of the Constitution, including the Federalist Papers and the arguments of the Anti-Federalists; and
- the addition of the Bill of Rights to the Constitution.

11.5 The student will analyze and explain events of the Early National Period, with emphasis on
- organization of the national government under the new Constitution;
- major domestic and foreign affairs issues facing the first presidents and Congress;
- the development of political parties;
- the impact of Supreme Court decisions affecting interpretation of the Constitution, including Marbury v. Madison and McCulloch v. Maryland;
- foreign relations and conflicts, including the War of 1812 and the Monroe Doctrine;
- the Louisiana Purchase and the acquisition of Florida; and
- economic development, trade, tariffs, taxation, and trends in the national debt.

11.6 The student will analyze the causes and effects of major events of the Civil War and Reconstruction, including
- slavery;
- States' Rights Doctrine;
- tariffs and trade;
- settlement of the West;
- secession;
- military advantages of the Union and the Confederacy;
- threat of foreign intervention;
- economic and political impact of the war;
- roles played by individual leaders; and
- impact of Reconstruction policies on the South.

11.7 The student will analyze the impact of immigration on American life, in terms of
- contributions of immigrant groups and individuals; and
- ethnic conflict and discrimination.

11.8 The student will summarize causes and effects of the Industrial Revolution, with emphasis on
- new inventions and industrial production methods;
- new technologies in transportation and communication;
- incentives for capitalism and free enterprise;
- the impact of immigration on the labor supply and the movement to organize workers;
- government policies affecting trade, monopolies, taxation, and money supply;
- expansion of international markets; and
- the impact of industrialization, urbanization, and immigration on American society.

11.9 The student will analyze and explain the importance of World War I, in terms of
- the end of the Ottoman Empire and the creation of new states in the Middle East;
- the declining role of Great Britain and the expanding role of the United States in world affairs;
- political, social, and economic change in Europe and the United States; and
- causes of World War II.

11.10 The student will analyze and explain the Great Depression, with emphasis on
- causes and effects of changes in business cycles;
- weaknesses in key sectors of the economy in the late 1920's;

- United States government economic policies in the late 1920's;
- causes and effects of the Stock Market Crash;
- the impact of the Depression on the American people;
- the impact of New Deal economic policies; and
- the impact of the expanded role of government in the economy since the 1930's.

11.11 The student will demonstrate an understanding of the origins and effects of World War II, with emphasis on

- the rise and aggression of totalitarian regimes in Germany, Italy, and Japan;
- the role of the Soviet Union;
- appeasement, isolationism, and the war debates in Europe and the United States prior to the outbreak of war;
- the impact of mobilization for war, at home and abroad;
- major battles, military turning points, and key strategic decisions;
- the Holocaust and its impact; and
- the reshaping of the United States' role in world affairs after the war.

11.12 The student will analyze and explain United States foreign policy since World War II, with emphasis on

- the origins and both foreign and domestic consequences of the Cold War;
- communist containment policies in Europe, Latin America, and Asia;
- the strategic and economic factors in Middle East policy;
- relations with South Africa and other African nations;
- the collapse of communism and the end of the Cold War; and
- new challenges to America's leadership role in the world.

11.13 The student will evaluate federal civil rights and voting rights developments since the 1950's, in terms of

- the Brown v. Board of Education decision and its impact on education;
- civil rights demonstrations and related activity leading to desegregation of public accommodations, transportation, housing, and employment;
- reapportionment cases and voting rights legislation and their impact on political participation and representation; and
- affirmative action.

11.14 The student will demonstrate an understanding of domestic policy issues in contemporary American society by

- comparing conservative and liberal economic strategies;
- explaining current patterns of Supreme Court decisions and evaluating their impact; and
- comparing the positions of the political parties and interest groups on major issues.

11.15 The student will explain relationships between geography and the historical development of the United States by using maps, pictures, and computer databases to

- locate and explain the location and expansion of the original colonies;
- trace the advance of the frontier and the territorial expansion of the United States and explain how it was influenced by the physical environment;
- locate new states as they were added to the Union;
- understand the settlement patterns, migration routes, and cultural influence of various racial, ethnic, and religious groups;
- compare patterns of agricultural and industrial development in different regions as they relate to natural resources, markets, and trade; and
- analyze the political, social, and economic implications of demographic changes in the nation over time.

11.16 The student will interpret the significance of excerpts from famous speeches and documents in United States history, including "The Letter from Birmingham Jail," "Speak softly and carry a big stick...," "The Gettysburg Address," and "The Virginia Statute of Religious Freedom."

11.17 The student will develop skills for historical analysis, including the ability to

- analyze documents, records, and data (such as artifacts, diaries, letters, photographs, journals, newspapers, historical accounts, etc.);
- evaluate the authenticity, authority, and credibility of sources;
- formulate historical questions and defend findings based on inquiry and interpretation;
- develop perspectives of time and place, including the construction of various time lines of events, periods, and personalities in American history; and
- communicate findings orally, in brief analytical essays, and in a comprehensive paper.

11.18 The student will develop skills in discussion, debate, and persuasive writing with respect to enduring issues and determine how divergent viewpoints have been addressed and reconciled. Such issues include
- civil disobedience vs. the rule of law;
- slavery and its impact;
- the relationship of government to the individual in economic planning and social programs;
- freedom of the press vs. the right to a fair trial;
- the tension between majority rule and minority rights;
- problems of intolerance toward racial, ethnic, and religious groups in American society; and
- the evolution of rights, freedoms, and protections through political and social movements.

Grade Twelve
United States and Virginia Government

The standards for the study of United States and Virginia government will ensure that graduates of Virginia's public schools understand the origins and workings of the American and Virginia political systems. The standards require that students have knowledge of the United States and Virginia Constitutions; the structure and operation of United States and Virginia governments; the process of policy-making, with emphasis on economics, foreign affairs, and civil rights issues; and the impact of the general public, political parties, interest groups, and the media on policy decisions. United States political and economic systems are compared to those of other nations, with emphasis on the relationships between economic and political freedoms. Economic content covers the United States market system, supply and demand, and the role of the government in the economy.

12.1 The student will compare the United States constitutional system in 1789 with forms of democracy that developed in ancient Greece and Rome, in England, and in the American colonies and states in the 18th century.

12.2 The student will identify examples of fundamental American political principles contained in the Virginia Constitution, the Declaration of Independence, the United States Constitution, and the Federalist Papers, and will compare them to principles of government and law developed by leading European political thinkers such as Locke, Hobbes, Montesquieu, Rousseau, and Blackstone.

12.3 The student will analyze the amendments to the United States Constitution in terms of the conflicts they addressed and the reasons for their adoption.

12.4 The student will summarize landmark Supreme Court interpretations of the United States Constitution and its amendments, with emphasis on basic freedoms, due process, equal protection of the law, and government powers, and will analyze the historical trends and contemporary patterns of United States Supreme Court decisions.

12.5 The student will identify and explain fundamental concepts of democracy, with emphasis placed on equality of all citizens under the law, the fundamental worth and dignity of the individual, majority rule and minority rights, the necessity of compromise, individual freedom, and the rule of law.

12.6 The student will analyze in writing, discussion, and debate current issues confronting local, state, and national governments in terms of perennial challenges to democracies, including conflicts between
- majority rule and minority rights;
- individual rights and the public interest;
- levels of taxation and the expectation of public services; and
- state and national authority in a federal system.

12.7 The student will analyze and compare national and state governments, with emphasis on
- the structures, functions, and authority of each;
- the principles of federalism, separation of powers, and checks and balances;
- the extent to which power is shared rather than divided or separated; and
- procedures for constitutional amendment.

12.8 The student will explain how United States and Virginia legislative, executive, and judicial institutions make public policy, in terms of
- legislation, regulations, executive orders, and judicial review;
- constitutional requirements and institutional procedures; and
- specific policies related to foreign affairs, civil rights, and economics and the budget.

12.9 The student will identify and distinguish among the units of local governments in Virginia, including counties, cities, towns, and regional authorities and will analyze a local public issue.

12.10 The student will explain and give current examples of how political parties, interest groups, the media, and individuals influence the policy agenda and decision making of government institutions.

12.11 The student will describe campaigns for national, state, and local elective office, including
- the nominating process;
- campaign funding and spending;
- the influence of media coverage, campaign advertising, and public opinion polls;
- demographic causes and political effects of reapportionment and redistricting;
- voter turnout and the constituencies of the major political parties; and
- the Electoral College.

12.12 The student will explain the rights, responsibilities, and benefits of citizenship in the United States and Virginia.

12.13 The student will develop the skills needed for informed participation in public affairs by
- analyzing public issues;
- evaluating candidates for public office;
- evaluating the performance of public officials; and
- communicating with public officials.

12.14 The student will compare the United States political and economic systems with those of major democratic and authoritarian nations, in terms of
- the structures and powers of political institutions;
- the rights and powers of the governed including grass roots citizen movements;
- economic goals and institutions and the role of government in the economy;
- the relationships between economic freedom and political freedom; and
- the allocation of resources and its impact on productivity.

12.15 The student will analyze the United States market economy, in terms of
- labor, capital, and natural resources;
- the interaction of supply and demand in markets;
- the role of private ownership, private enterprise, and profits;
- the relationships of households, firms, and government;
- labor/management relationships; and
- relationships to the global economy.

12.16 The student will analyze the role of government in the United States economy, with emphasis on
- monetary and fiscal policies;
- interstate commerce and international trade policies;
- providing favorable conditions for markets;
- providing public goods and services;
- protecting the environment; and
- promoting economic growth.

12.17 The student will evaluate the effect of monetary and fiscal policies on personal economic well-being including employment opportunities, purchasing power, credit and interest rates, and opportunities for investment and savings.

12.18 The student will define common economic terms, including productivity, recession, depression, the business cycle, and inflation, and explain and interpret indicators of economic performance, including gross domestic product, consumer price index, unemployment rate, balance of trade, and stock market averages.

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